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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

ROCAP

PROJECT PAPER

REGIONAL TROPICAL WATERSHED MANAGEMENT

AID/LAC/P-145

Project Number:596-0106

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: _____

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: ROCAP

3. PROJECT NUMBER: 596-0106

4. BUREAU/OFFICE: Latin America and the Caribbean — 05

5. PROJECT TITLE (maximum 40 characters): Regional Tropical Watershed Management

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 07 DD 31 YY 88

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 83 B. Quarter 4 C. Final FY 87

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 83 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	440	260	700	3776	2224	6000
(Grant)	(440)	(260)	(700)	(3776)	(2224)	(6000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country					1460	1460
Other Donor(s)						
TOTALS	440	260	700	3776	3684	7460

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1)	SD	740	876			6000		6000	
(2)									
(3)									
(4)									
TOTALS									

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 851 | 874 | 700

11. SECONDARY PURPOSE CODE:

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	ENV	TNG	TECH			
B. Amount						

13. PROJECT PURPOSE (maximum 480 characters)

To improve the institutional capacity in Central America and Panama for managing the region's watershed resources.

14. SCHEDULED EVALUATIONS
Interim MM 03 YY 85 | MM 06 YY 86 | Final MM 08 YY 88

15. SOURCE/ORIGIN OF GOODS AND SERVICES
[X] 000 [ ] 941 [X] Local [ ] Other (Specify) _____

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a _____ page PP Amendment.)

17. APPROVED BY
Signature: Paul A. Montana 6/30/83
Title: Director
Date Signed: MM 06 DD 30 YY 83

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

AID 1330-4 (8-79)

Project Authorization

Name of Entity : Tropical Center for Agricultural Reseach and Training (CATIE)

Name of Project : Regional Tropical Watershed Management

Number of Project: 596-0106

1. Pursuant to Section 106 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Tropical Watershed Management Project with the Tropical Center for Agricultural Research and Training ("CATIE"), involving planned obligations of not to exceed Six Million United States Dollars ($6,000,000) in grant funds ("Grant") over a five-year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.

2. The project ("Project") consists of assistance to CATIE to strengthen the watershed management, planning and implementation capacities of national and regional organizations in Central America and Panama through a) training, b) advisory services and c) support services.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Grant shall have their source and origin in countries which are members of the Central American Common Market ("CACM"), Panama, or the United

States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have countries which are members of CACM, Panama or the United States as their place of nationality, except as A.I.D. may otherwise agree in wirting. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent to Disbursement

(1) Prior to the initial disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities under the Grant, CATIE shall, except as A.I.D. may otherwise agree in writing, furnish, in form and substance satisfactory to A.I.D., a detailed time-phased plan setting forth all activities to be completed during the first year of the Project.

(2) Prior to the disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities in any one of the participating countries, CATIE shall, except as A.I.D. may otherwise agree in writing, furnish, in form and substance satisfactory to A.I.D., an executed letter of agreement with the primary natural resource institution of that particular eligible participating country. The letters of agreement shall, inter alia, contain provisions which outline the roles of CATIE and the national institution; establish working relationships between CATIE, country coordinators and national institutions; and identify national inputs to the Project.

c. Covenants

CATIE shall covenant that, except as A.I.D. may otherwise agree in writing:

(1) All fees and services provided under the Project shall be used to finance costs related to the Project;

(2) CATIE shall provide facilities support and data services equivalent to counterpart values estimated in the budgets of the Project Agreement;

(3) CATIE shall provide appropriate housing for the long-term advisors at CATIE funded under the Project Agreement;

(4) CATIE will coordinate Project Activities with USAID missions in each country which participates in this Project;

(5) Prior to undertaking Project activities for each year after the first year of the Project, CATIE will furnish, in form and substance satisfactory to A.I.D., a consolidated workplan and budget for activities for that year.

Marshall D. Brown
Acting Assistant Administrator
Bureau for Latin America and
the Caribbean

July 26, 1983
Date

Clearances:
GC/LAC:RMeighan date 7/26/83
LAC/DR:DJohnson date 7/26/83
LAC/DP:HJohnson date
LAC/CEN:RQueener date 7/26/83

GC/LAC:PJohnson/gw 0044L/7/22/83

TROPICAL WATERSHED MANAGEMENT

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STANDARD EXHIBITS

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A. OICD/USDA Summary Report

B. CATIE's Plan to cover costs anc continue activities after PACD

C. Project Staff Job Descriptions

D. CATIE Comparative Financial Statements, Financial Plan Details and Cost Narratives

E. Cases of Watershed Degradation

F. Summary of Watershed Management Survey

COMPOSITION OF PROJECT DEVELOPMENT COMMITTEE

ROCAP

- Chairman
  Peter B. Lapera, Asst. Project Development Officer

- Chief Technical Advisor
  Frank Zadroga, Regional Environmental Management Specialist

- Other Participants
  Mario Calderon, Financial Analyst
  Larry Grizzard, Deputy Controller
  Julian Heriot, Economist
  Kevin Kelly, Project Development Officer
  Edward Nadeau, General Development Officer
  Henry Tschinkel, Forestry Advisor

- Review Officers
  John R. Eyre, Deputy Director
  Paul Montavon, Director

AID/Washington
Joanne Connolly, Finance Officer
James Hester, LAC/DR Environmental Officer

CATIE
Gilberto Paez, Director
Gerardo Budowski, Chief DRNR
Craig McFarland, Head Wildlands Program
Carlos Quesada, Watershed Management Specialist
Roger Morales, Staff Assistant DRNR

USDA/OICD
Jerry Dutchover, Soil Conservationist
Robert Gale, Economist
Ronald Hodgson, Instructional Design and Materials Specialist
Dietmar Rose, Forestry Economist/Natural Resources Data Base Specialist
Mervin Stevens, Training Coordinator, Forestry Support Program

A summary of the USDA/OICD team's report is included in Annex II.A. Copies of individual team member reports are on file at ROCAP and LAC/DR.

LIST OF ACRONYMS

CA/P	:	Central America and Panama
CATIE	:	Tropical Agricultural Research and Training Center
CEP	:	Country Environmental Profile
CRIES	:	Comprehensive Resources Inventory Evaluation System
DDA	:	Swiss Development Assistance
DRNR	:	Department of Renewable Natural Resources
ESNACIFOR	:	National Forestry School (Honduras)
ERIS	:	Regional School of Sanitary Engineering (Guatemala)
FAO	:	Food and Agriculture Organization
IBD	:	Interamerican Development Bank
IBRD	:	International Bank for Reconstruction and Development
IICA	:	Interamerican Institute for Agricultural Cooperation
PASC	:	CATIE Wildlands and Watersheds Program
WWF	:	World Wildlife Fund

I. PROJECT SUMMARY AND RECOMMENDATIONS

A. Recommendations

The Project Development Committee recommends that a $6.0 million grant be authorized to implement the Regional Tropical Watershed Management project.

B. Summary Description

1. Goal and Purpose

Water is one of the region's most abundant and important natural resources, and its use must be effectively planned if the expected returns on present and future investments in practically all sectors of the economy are to be achieved. The goal of the project is to protect the environment and conserve natural resources with special emphasis on maximizing the contribution of water to the social and economic development of the participating countries.

The various resources which make up watersheds are responsible for the natural protection and quality of water supplies. Thus, effective use of water must begin with the management of those resources. Given this basic tenet, the purpose of the project is to improve the institutional capacity in Central America and Panama for managing the region's watershed resources.

2. Background and Project Activities

The Country Environmental Profiles (CEPs) which have been prepared for several countries in the region and other reports indicate that the region's watersheds are deteriorating because of deforestation, improper land use and other factors, and that this will become an even more critical development problem in the future. There are striking examples of the high cost that is already being paid on specific investment projects for inadequate watershed management, but the impact of neglect over the next decades may well be measured in more global terms of permanently reducing the region's overall development prospects.

Watersheds for existing and future hydroelectric projects constitute one of the Central America's few major natural resources. Enormous investments are being made for hydroelectric projects as a means to reduce dependence on imported oil, and the potential for further developing and sharing low cost electrical power to spur industrialization and

exports has only started to be exploited. Likewise, the potential for using irrigation to improve agricultural productivity in domestic food and export crops has barely been tapped.

There are several USAID bilateral projects, as well as other donor activities, aimed at arresting the deterioration in the region's watersheds and water resources, but they are only a start and have met with limited success. Attempts to carry out appropriate management activities generally face four interrelated obstacles:

-- Lack of appreciation of the consequences of improper resource management, of the interdependencies between resources and of the downstream impacts of upstream land use.

-- Weak land management institutions with insufficient qualified staff and budgets in relation to their responsibilities.

-- Inadequate, often conflicting, land use policies and plans, without clear assignment of responsibility for their execution.

-- Insufficient locally proven alternate land use techniques for mountain watersheds and inadequate methods of technology transfer and delivery systems to take full advantage of experience elsewhere.

The proposed project will attack each of the four problem areas identified above, although some more directly and with greater emphasis than others. The thrust of the project will be in strengthening those regional and national institutions responsible for watershed management through long and short term training offered by the project directly, as well as assistance in the development of curricula and provision of instructional materials. Technical assistance will help improve national watershed planning methodologies, assist in the elaboration of watershed plans, and provide computerized information including statistics, documentation and maps needed for planning and policy decisions. The development and transfer of new land-use techniques will be facilitated by the project's information system. In addition, the project will include systematic efforts within the above framework at raising awareness.

The efforts described above are to be carried out by three project components: Training, Advisory Services, and Support Services at CATIE.

a) Training

The training component will: (1) develop an in-house training capacity in tropical watershed management at CATIE; (2) develop the technical capacity of national institution staff; and (3) increase awareness of the benefits of watershed management at all levels of national governments. It includes the following activities:

-- CATIE Graduate Program

A masters degree program and a "visiting scholar program" at CATIE with emphasis on relevant, country-oriented theses and other work.

-- Foreign Study Program

A program of post graduate study at U.S. and Latin American Universities.

-- Short Courses

Structured one to three week courses covering the range of watershed related topics requested by national institutions.

-- Workshops and Seminars

Shorter events to be held at the country and regional level with the purpose of increasing awareness and appreciation for watershed management.

-- Study Tours

Field visits to watershed projects, technical sites, and international meetings.

b) Advisory Services

This component will provide both short and long-term technical assistance in areas requested by the national institutions, USAIDs and other donors and build an

in-house capacity at CATIE to offer such assistance after the project ends. Special technical assistance programs will also help develop instructional materials, improve national training efforts and develop national and regional data base information.

Initially the same specialists who will be teaching graduate and short courses will also provide technical assistance. They will be assisted by short-term consultants and by CATIE's country coordinators who will work with national institutions and USAIDs to define specific technical assistance requirements.

c) Support Services at CATIE

The support services consist largely of facilities that will be put in place at CATIE to support training and advisory services. They include: a Regional Data Base, an Instructional Design and Materials Office and a Project Information Office.

3. Summary Financial Plan

	ROCAP	CATIE	Host Gov.	Total
Personnel Costs	2,175	984	423	3,582
Training	1,155	190	739	2,084
Travel & Per Diem	305	33	41	379
Equipment	414	198	100	712
Other Costs	930	55	93	1,078
Overhead	732	-	-	732
	5,711	1,460	1,396	8,567
Contingency	289			289
	6,000	1,460	1,396	8,856

C. Summary Findings

The Project Committee has reviewed all aspects of the proposed Regional Tropical Watershed Management Project and finds that it is technically, financially, socially and economically sound, and consistent with those objectives set forth in ROCAP's CDSS strategy and AID/W policy guidance. The Committee has further found that CATIE is institutionally

capable of administering their respective components of the project.

The USAIDs have been consulted extensively during the development of the PP and three of the USAIDs (Costa Rica, Honduras and Panama) sent representatives to participate in a project design/coordination meeting held at CATIE on May 5, 1983. Subsequently, the final draft PP was distributed to the USAIDs for review on June 14th with a request that they cable comments in time to permit ROCAP to take them into account before putting the PP into final and submitting it to AID/W on June 30th. Formal comments were not received from all the USAIDs by that date, but the Project Committee believes that all major project issues have been resolved in the consultation/design process and that there is a USAID consensus that the project is a reasonable regional initiative which complements bilateral efforts and should be approved.

II. PROJECT BACKGROUND

A. Importance of Water Resources in Central America and Panama

Central America is one of the most ecologically and hydrologically diverse regions of the world. Basically due to its rugged mountainous relief which is swept with both Atlantic and Pacific climatic/wind systems, ample water resources are available. Two climatic periods are generally experienced throughout the region: the dry summer season and the wet winter season. The Atlantic coast generally has a wetter and more evenly distributed rainfall pattern, and the Pacific has relatively less rainfall which is unevenly distributed in a more pronounced wet-dry regime. As a result of this seasonality and geographic heterogeneity Central America and Panama (CA/P) is subject to serious water problems, including scarcity and flooding.

The major demands for water use and control in the region include: potable water supplies, hydroelectric power generation, irrigation, flood control, navigation and tourism. Numerous studies taking into account population, GNP and resource projections all predict rapidly increasing demands for fresh water. Water use relating to hydroelectric power, potable water supplies and agriculture (principally irrigation)

are expected to put greatest demands on CA/P water resources over the 1980-2000 period.

Perhaps most striking is water's development impact and potential in the provision of energy through the generation of hydro-electricity. Approximately 66% of the electrical energy currently produced in the region comes from this source. Nonetheless, a large amount of energy must also be produced from petroleum based sources and, in 1981, the oil consumed by thermal power plants accounted for 20% of the region's $1.0 billion oil import bill. This foreign exchange demand has been an important contributing factor to the economic crisis which has confronted the region for the past several years.

To reduce their dependence on imported oil, the Central American countries have been developing various alternative sources for providing energy. As shown in the following table, the greatest emphasis has been in the development of hydro-electricity, where the region has a strong comparative advantage relative to other areas because of its rainfall and topography:

TABLE 1

NEW INVESTMENTS IN CENTRAL AMERICA ENERGY
PROJECTS APPROVED IN 1981
($ millions)

	G	ES	H	N	CR	TOTAL
Hydroelectric	325.7	67.3	86.1	12.0	93.1	584.2
Geothermal	4.8	5.7	-	14.3	3.7	28.5
Thermal Electric	0.1		-	-	-	0.1
Transmission Lines	2.8	0.8	3.3	4.6	20.2	31.7
Hydrocarbons	47.0	-	-	-	-	47.0
Non-Conventional	-	-	-	0.2	0.7	0.9
	380.4	73.8	89.4	31.1	117.7	692.4

Source: Eleventh Report on the Inventory of Regional Infrastructural Projects in Central America through December, 1981, SIECA, Published November 1982.

The level of investment in energy projects in 1981, $692.4 million, compares to a total of $435.5 million in 1980 of which $348.2 (80%) was for hydroelectric projects. By 1990, it is estimated that an additional $3.6 billion will be spent on hydroelectric projects, and that the region will nearly eliminate dependency on thermal power plants by its investments in hydroelectric plants and interconnecting transmission grids.

The generation of energy is only one facet of the role which water has in the growth and development of Central America and Panama. In agriculture, about 5% of the cultivated land is now under irrigation. These lands are devoted mostly to high value commercial crops, are highly productive, and provide a very large share of the region's export earnings.

No precise estimates of the region's irrigation potential or its possible contribution to the total value of agricultural production are available, but it is apparent that it is substantial. For example, the 5% of the area's cultivated land under irrigation can be compared to 23.6% in Mexico, where the irrigated land produces more than 50% of the value of agricultural production. The importance of irrigation to increasing agricultural production is recognized in Central America and Panama and new projects are being developed. These projects will also require huge investments with costs averaging on the order of $4,000 per hectare.

In addition, many industries use water in the production process, and the urban growth which characterizes the region today must have water for drinking, household use and sewage disposal. Urban requirements will also grow, particularly if the current pattern of migration from rural areas is maintained. Most notably, the growth of urban centers will put tremendous localized pressure on water supplies.

Yet, whether water can make the economic and social contributions to development noted above in the next few decades is in serious doubt because of the lack of appropriate watershed management and the resulting resource degradation. Rapid deforestation and soil erosion are two examples, and are major contributors to accelerated siltation of hydroelectric dams and depletion of productive top soil needed for agriculture and the consequent economic losses which are suffered.

B. The Concept of Watershed Management

A watershed is defined as the land or geographic area that collects and discharges its surface stream flow through one common outlet. It serves as an appropriate unit of integrated natural resource planning and management because it consists of a well-defined topographic boundary, a drainage area, and a water course constituting a river or stream. It includes all of the natural resources in the basin particularly the water, soil and vegetation.

Watershed Management is a multi-disciplinary activity that integrates a number of technical fields according to the physical, biological, and socio-economic realities of the particular watershed being treated. Numerous disciplines concerned with resource planning and management are involved, including: land-use planning, resource inventory and land classification; forest management; agroforestry; soil and water conservation; water resources engineering; wildlands and wildlife management and protection; and pollution control. This integrated approach is especially appropriate for Central America and Panama where the topography and climatic conditions contribute to very pronounced watersheds, and where watershed resources play a critical role in economic development.

A plan for a given watershed depends on the intended use or mix of uses of the watershed. The natural resource characteristics of the watershed, the needs of its inhabitants, both upstream and downstream, and the economy of a given region or country will dictate whether the watershed should be used primarily for potable water, hydroelectric projects, forestry, farming, etc., or a combination of such uses.

To a large extent the uses determine the set of practices that should be applied to the natural resources in the watershed. For example to improve small farm production, practices such as gully control, pasture improvement and agroforestry may be applied. To provide the optimum amount, quality and timing of water resources for hydroelectric projects, a forest reserve may need to be created, perhaps in combination with water management and stream bank protection practices.

The tasks of watershed planning and management involve assessing the natural resources of watersheds and the various demands which may be in conflict and deciding on a priority use or optimum mix of uses. Based on these assessments management plans can be designed to include appropriate land and water use practices.

C. Consequences and Impacts of Watershed Degradation

The consequences of watershed deterioration can be expressed both in terms of environmental impacts as well as economic costs and losses of development opportunities. Sometimes the results are short-term and dramatic, but more often they are long-term, and subtly recur in damage caused by natural disasters. The following examples from each of the participating countries illustrate the range of consequences which result from watershed deterioration and underscore the fact that the countries face common problems which are vital to the region's development.

In the Sula Valley of Honduras, over a geographic area of 370 sq. kms., improper land use (deforestation of protection forests on steep uplands followed by annual burning, overgrazing and/or slash and burn agriculture) has led to flood damages to agriculture and infrastructure averaging $33.5 million annually. Floods resulting from the heavy rains of Hurricane Fifi in 1974 were the worst on record and so were the resultant damages to life and property.

The Rio Lempa in El Salvador has been intensively developed for hydroelectric power generation but with little regard for watershed management. Poor land use has led to the accelerated siltation of the 5th of November dam, reducing its useful life to approximately half of what was expected when the dam was constructed in 1954. By 1977, its volume was so reduced by siltation that it had no regulatory capacity. Deterioration of vegetation and soils also has caused accelerated runoff and diminished water storage in the watershed, thus reducing the generating potential of the overall hydroelectric system. These gradual, insidious impacts are now taking their toll on the newer and larger Cerron Grande dam built upstream.

The Pueblo Viejo hydroelectric project in Guatemala will require over $100 million (in 1982 prices) in additional structures to reduce the siltation of the reservoir. Subsequent studies have shown that if watershed management had been considered as an integral part of the original investment, the sedimentation rate of the reservoir could have been reduced by over 50% perhaps avoiding the need for expensive additional structures to control siltation.

The Cachi site in Costa Rica is an example that points to specific economic losses that can result from unanticipated reservoir siltation. In this case, a study revealed that

siltation will result in a revenue loss amounting to $133 to $274 million in 1982 dollars. The Cachi dam was constructed less than twenty years ago.

One of the most striking examples of siltation in the region is in Panama. The lake which is the primary supplier of water to operate the Panama Canal would lose 80% of its storage capacity by the year 2020, if siltation rates existing before the AID bilateral Watershed Management was approved in 1979 were to continue. Factors leading to the decision to undertake the AID project were the fact that siltation rates had doubled over a ten year period due to inadequate watershed management and that the project's economic analysis indicated a high rate of return from the AID investment.

Examples such as these which demonstrate economic loss in terms of both damage to property and life and damage to hydroelectric development are discussed in more detail in Annex II.E.

In addition to examining the numerous individual examples of watershed degradation, a larger global picture of deforestation can be painted to illustrate the seriousness of the problem. Forests are disappearing at an alarming rate due to a complex series of factors such as the increasing demand for fuelwood and growing commercial logging, as well as the demand for additional land to put into agricultural production. For example, between 1952 and 1978 forest cover in Panama declined from 83% of total land area to only 32%, while in Costa Rica tropical forests decreased by 41% between 1950 and 1977. Deforestation has not yet been brought under control by appropriate national level institutions nor is it generally viewed within the integrated framework that watershed planning and management provide. Throughout the region, however, the potential adverse long-term impacts of deforestation and watershed degradation are beginning to be recognized.

D. Causes of Watershed Degradation

The principal direct causes of watershed degradation include:

-- Deforestation of protection and production forests lands by conversion to use for agriculture and grazing;

-- Accelerated soil erosion of uplands due to improper land use;

-- Inappropriate crops and cultivation techniques;

-- Overgrazing;

-- Burning; and

-- Road construction, especially into protection watershed areas.

Of these, the deforestation and conversion of steep marginal uplands to support agriculture and livestock uses is the major contributor. When deforestation occurs in steep protection watersheds where water resources are developed for municipal water supplies, flood control, hydroelectric dams, or downstream irrigation, impacts can be especially costly and difficult, if not impossible, to reverse.

E. Statement and Analysis of the Problem

One reason that watershed deterioration continues its alarming course in Central America and Panama is that efforts to manage watersheds rationally are inadequate. Attempts to carry out appropriate management activities generally face four interrelated obstacles:

-- Lack of appreciation of the consequences of improper resource management, of the interdependencies between resources and of the downstream impacts of upstream land use. This situation runs from the high level decision maker who assigns financial resources down to the small farmer.

-- Weak land management institutions with insufficient qualified staff and budgets in relation to their responsibilities.

-- Inadequate, often conflicting, land use policies and plans, without clear assignment of responsibility for their execution.

-- Insufficient locally proven alternate land use techniques for mountain watersheds. Methods of technology transfer and delivery systems are usually inadequate to take full advantage of experience elsewhere.

Three recent systematic studies have analyzed these problems:

A study undertaken by the World Wildlife Fund* described constraints to effective natural resources management in Latin America in general. The study demonstrated that a lack of awareness underlies the existing situation: in politics, little attention is given to conservation; in planning, decisions with large impacts on natural resources are made without proper analysis; in government administration, many countries have no agencies which are truly accountable forsoil conservation or watershed management; in the legal aspects of natural resources management, protective laws and regulations are often not enforced. These observations generally apply to the management of watershed resources in Central America and Panama.

A report completed for ROCAP by two contractors** described institutional causes of poor watershed management related to the lack of awareness which stem from a lack of direction from top echelon decision-makers. One of these is that the responsibility for watershed management is not clearly defined among the national institutions. A corollary is that these institutions poorly coordinate watershed management efforts. An example, which is generally true for all of the countries, is the unclear designation of management/control responsibilities between the electric institutes and the natural resources institutes regarding watersheds which feed into the hydroelectric projects. Another consequence of lack of direction of decision makers is the confused state of legislation that negatively affects watershed management. Maintenance of watersheds is not regulated and if legislation does exist it is not effectively enforced.

The contractors' reports also pointed to several causes of poor watershed management at the institutional level. These interrelated constraints are poor planning, a need for trained personnel and a need for technical expertise at both the institutional and field levels. At the highest level of

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* Situation and Trends of Renewable Natural Resources of Latin America and the Caribbean. World Wildlife Fund, July, 1980.

**Ing. Luis Garcia, Analysis of Watershed Management (El Salvador, Guatemala, Honduras).
Paul Dulin, Suggestions for a Regional Watershed Management Project (Nicaragua, Costa Rica, Panama)

planning, most activities related to watershed management have originated from individual sectoral needs and not from a comprehensive view of natural resource conservation as part of a national development strategy. At the level of the natural resource institute, watershed management plans are incomplete or unworkable, frequently do not take into account other sector needs, or for one reason or another cannot be applied at the field level.

In order to more clearly define the perceived needs of the national institutions in watershed management, ROCAP financed a region-wide survey in February-March, 1983. (A summary of this survey is presented in Annex II.F). The survey encompased a wide range of institutions, including forestry, natural resources and planning agencies, as well as national electric companies, ministries of agriculture, and national universities. These institutions were divided into primary and secondary, depending on the degree of responsibility for watershed management. A total of fifty institutions were contacted in the six countries, of which 31 were classified as primary and 19 as secondary. The questionnaire survey covered four areas: training, technical assistance, information and awareness.

The responses to the questions on training are very useful in pinpointing priority needs. All fifty institutions indicated that current personnel require more training in watershed management. Given staff shortages, most institutions stated a preference for short-term training, but at the same time expressed support for both medium and long-term training where appropriate. The preferred training topic of the majority of institutions, for both short-term and long-term training, is watershed management and planning. Other topics of interest include watershed management project preparation and analysis, environmental impact analysis, and soil conservation.

The desire for improved planning was again reflected in technical assistance needs. Survey results show that the national institutions require assistance in more specific and/or sophisticated natural resources techniques relating to economics, information systems, soil conservation and forest hydrology.

All institutions indicated a need for more information including inventories of watersheds which would provide relevant determinants such as rainfall, runoff and other factors in the behavioral pattern of watersheds. Also needed

is documentation on alternative plans and strategies which could be applied to watershed deterioration. All of the institutions also support a regional information system as a means of improving the collection and distribution, including the exchange of needed information and would be willing to provide information to a center for such a system.

Responses to the several questions on awareness of the importance of watershed management indicated that awareness decreases at higher levels, i.e., division chiefs have "high" awareness, directors of institutions medium awareness, and ministers "low". The latter is viewed as an obstacle to appropriate policy development and effective field implementation of watershed management efforts.

III. PROJECT RATIONALE

A. Focus of the Project

The proposed project will address each of the problem areas identified above, although some more directly and with greater emphasis than others.

The principal thrust of the project will be in strengthening those regional and national institutions responsible for watershed management. This will be done through long and short term training offered by the project directly, as well as limited assistance in the development of curricula for national training institutions. Instructional materials developed by the project staff, which will have an impact beyond the geographic and time limits of the project, will enhance the effectiveness of the training provided.

Through technical assistance, the project will improve watershed planning methodologies, assist in the elaboration of watershed plans, and provide computerized information including statistics, geophysical descriptions and maps needed for planning and policy decisions.

The adaption and dissemination of land-use techniques will be facilitated by the project's information system which, in addition to providing general technical information needed to make planning and policy decision, will permit the identification of analogous areas and access to documented experience. Project specialists will also assist in the design, field testing and evaluation of promising techniques developed in the U.S. and other areas of the world. This process will facilitate the application of planning

methodologies and management techniques developed in one area to other, similar areas.

The project will include systematic efforts at raising awareness through the preparation of easily understandable technical information, the organization of seminars and conferences, the placement of country coordinators with close links to national institutions and the creation at CATIE of a program designed to provide continued assistance to national institutions over the long-term.

B. Relationship to Bilateral AID Programs

AID is presently financing watershed management or related bilateral projects in Honduras, Costa Rica and Panama with a total LOP cost $29 million. USAID/El Salvador is financing reforestation and soil conservation under an employment generation project at the rate of approximately $6 million per year for 1982 and 1983. In addition, new natural resource projects or extensions are in advanced planning stages in Honduras, Panama and Guatemala. The present project is designed to support these bilateral efforts.

1. Honduras

The Natural Resources Management Project has initiated watershed management activities in sub-watersheds of the Rio Choluteca. Emphasis is on encouraging peasants to carry out soil conservation, improved cropping on the terraced land, and establishment of farm woodlots. The project has been hampered by scarcity of qualified local personnel with watershed management background, especially at the professional level. Contracting of the technical assistance team has been delayed 1-1/2 years after initiation of field operations. Selection and planning for new sub-watersheds and working sites is difficult because information about the Choluteca watershed is inadequate and not readily accessible. All of these are needs which the Watershed Project will address.

In response to recommendations of the U.S. Presidential Agricultural Commission which recently visited Honduras, it is possible that USAID/Honduras will soon design a new forestry project. Any large forestry project would have a need for watershed management training, expertise and information.

ESNACIFOR, the mid-level forestry school, located in Honduras, has given increased importance to serving

the region (about 40% of its students come from outside Honduras). Technicians trained at the school serve on AID projects throughout LAC. Watershed management is taught as part of the general curriculum. The U.S. Presidential Agricultural Commission has recommended support of the school and this is likely to be forthcoming from USAID/Honduras and/or central funding. The school will be one of the primary beneficiaries of curriculum development and design of instructional materials under the proposed project.

2. Costa Rica

The Natural Resource Conservation Project is preparing a management plan for the large Parrita watershed, supporting park planning, carrying out soil conservation, extension and reforestation with small farmers in the Nasara pilot watershed and elsewhere in the Pacific region, and is initiating management of an area of tropical moist forest. External technical assistance in watershed management is being recruited because of the scarcity of this expertise in Costa Rica. Part of the training component is being used to support local universities, all of which would also benefit from the present watershed project. The information management system applied to watershed and park planning and the advisory support services of the proposed project will be of immediate and direct benefit to the NRC Project.

3. Panama

The implementation of the Panama Canal Watershed Management Project is seriously limited by the scarcity of qualified personnel with watershed experience in RENARE. Training funds are far from adequate to cover the need. In this project also, the complexity of contracting technical assistance from outside the region caused long delays in its arrival.
An evaluation of this project will be completed soon which may lead to a new follow on project. That project would benefit substantially from the proposed regional project.

4. El Salvador

Because soil conservation and reforestation are carried out as part of a local currency financed employment generation project, there are no funds available for external technical assistance, a need that could be partially fulfilled by the proposed Project.

5. Guatemala

The PID for the Altiplano Development Project contemplates soil conservation and planting of community woodlots. These activities will require training of professionals and planning activities under the USAID/Guatemala project will benefit from the proposed Project's data base.

The above summary of bilateral USAID efforts in natural resource management, illustrates that most USAID projects in Central America and Panama share certain common needs, namely:

-- Training in watershed management at various levels, responsive to local needs.

-- Rapidly deployed technical assistance with local experience and adequate backstopping and follow-up.

-- Readily accessible information sources for natural resource planning, for technology transfer and for the improvement of new techniques.

These common needs are most effectively met through a common regional approach, which supports the efforts in each country. The proposed Regional Tropical Watershed Management Project is designed to address these needs and thereby to assist the bilateral missions in improving the performance of their projects.

C. Advantages of a Regional Approach and the Role of CATIE

The ROCAP regional watershed survey, the CA/P environmental profiles, numerous CATIE investigations, as well as those conducted by ROCAP's consultants, and the increased activities of numerous natural resource institutions of several countries all indicate a region-wide pattern of increasing concern about watershed degradation on the one hand and an increasing demand by a variety of water uses on the other. Every Central American CDSS directly identifies natural resource degradation, sometimes in combination with agriculture or with alternative technology or energy, as a major problem area. Although the severity of the problem and the needs vary among the countries, investigations reveal that all participating countries have critical or potentially critical problems of watershed degradation. The degradation will

severely impair possibilities for economic growth and reduce viable development options.

The components of the proposed project have been designed in such a way as to insure broad regional application. In general, the technologies to be disseminated under the project to address watershed degradation are not country-specific. Assistance for common technical problems in watershed planning, such as land use capability and resource management, will be offered principally through cost-effective training and advisory services. Experience from both the Small Farm Production System and Fuelwood projects has developed a capacity at CATIE for working with national institutions and for transfering appropriate technologies which are known to be effective. Other institutional constraints common to all the national institutions will be reduced through an improved data base, and better instructional materials and information services. Planning and management of international watersheds important to energy grids established among the countries will also be improved. Discussions with national institutions and USAIDs reflect a high degree of interest in the project. To ensure that neither duplication of effort nor by-passing of national institutions occurs, all operations in the countries will be carried out through the national institutions and USAIDs will be consulted on a regular basis.

The activities described above, while not countryspecific are also best carried out through a regional approach. The major reasons for this are the economies and cost-effectiveness of installing a comprehensive training program at CATIE instead of five or more national levels and relatedly, the cost-effectiveness of providing technical assistance at a lower rate using the resources of CATIE instead of more expensive U.S. or other foreign sources. The approach of providing a mix of training and technical assistance also ensures the continuity of the capacities for watershed management that will be established or improved.

The regional approach is also advantageous because it will benefit from CATIE's many years of technical experience in crop and livestock production and natural resources management in Central America and Panama. CATIE's forestry experience extends over 30 years and its Department of Renewable Natural Resources has staff and ongoing activities in all countries. These activities cover a mix of natural resource management disciplines including agroforestry, fuelwood production, silviculture, resource planning, native forests, wildlands and most recently watershed management. The regional approach

will promote the sharing of this experience and other expertise which may have been developed in individual countries with the other participating countries.

Another advantage of a regional approach is that it facilitates the application of watershed planning and management technologies to international watersheds such as Changuinola Teribe and Sixaola basins between Panama and Costa Rica and the Rio Lempa basin between Guatemala, El Salvador and Honduras.

D. Relationship of the Project to AID Policy, Mission Strategy and Other Donor Activities

1. Relationship to AID Policy

AID's concern for forestry, environment and natural resources has been expressed in five recent policy and strategy documents. Watershed management is specifically identified as an important element of the AID program in each paper. These include: Policy Determination 74, A.I.D. Forestry Programs and Policies, dated April 15, 1981; Policy Determination 6, Environmental and Natural Resource Aspects of Development Assistance, dated April 26, 1983; Agency Environmental Sector Strategy Paper, dated December 18, 1982; Agency Forestry Sector Strategy Paper, dated December 18, 1982; and the recent LAC Regional Strategy Statement. In each case an emphasis is placed on institution building and training as the best method to approach watershed management. The ROCAP Watershed Management Project has been designed to closely conform to this policy and strategy guidance.

2. Relationship to ROCAP Strategy

One of ROCAP's assistance goals is "to help Central Americans better develop, manage and conserve the region's natural resources." ROCAP started several years ago to pursue activities related to this goal. The Fuelwood and Alternative Energy Project addresses what is probably the most serious element of the problem - deforestation. ROCAP has on its staff an environmental management specialist and a forestry advisor, who assist AID bilateral missions and regional and national institutions in their respective fields. For example, Country Environmental Profiles for most of the CA/P countries have been prepared with ROCAP assistance. (Without exception each of these Profiles identifies watershed degradation as a major problem). To help build a natural resource information base, ROCAP has been supporting adoption of the Comprehensive

Resource Inventory and Evaluation System (CRIES), which will be utilized and expanded by the present project. Thus the proposed project will draw on ROCAP's experienced staff and will build on other project activities carried out in previous years.

3. Other Donor efforts in Watershed Management in Central America

Few forestry or watershed management projects have been designed or financed in Central America by major donors, although the World Bank (IBRD) and the Inter-American Development Bank (IDB) have successful related projects in South America, particularly in Uruguay, Peru and Colombia. IBRD and IDB technicians cite the higher technical and management capacity of the South American national natural resource institutions as a major reason for project investment there rather than in Central America.

Watershed management, or more precisely, a forestry development management, is a component of the $25 million World Bank Second Agricultural Credit Project in Honduras. The purpose of the forestry component is to develop, on a pilot scale, the organization and management systems necessary to initiate a major national reforestation program. The formation of a forest management unit and a total of 36 man/months of training for the staff of COHDEFOR are planned.

The IDB's $13.4 million Comayagua Forest Development Program in Honduras has been working with COHDEFOR since 1981 to increase management capacity in forest conservation. The Comayagua plan is a comprehensive effort to manage some of the forests of the El Cajon watershed. The El Cajon hydroelectric project, now under construction, will be the largest in the country. It has been noted by the IDB officer that the training aspect of the proposed AID project would have been a useful and valuable support. Other IDB projects, such as the $50,000 reforestation project in Panama, are small in scale and modest in expectation because of the limitations of the implementing institutions.

Nonetheless, major investments are planned for the future. The IDB is designing a $50 million integrated watershed management project in Chixoy, Guatemala, but feasibility studies are suspended for the present because of unrest in the area. When project progress becomes possible, a number of natural resource institutions will implement the project, and the project may have to include training to strengthen their staffs. Further upstream, the IDB is also in the initial planning states of an integrated watershed watershed project in Kiotique, El Salvador.

The proposed ROCAP project is welcomed by the major donors because it will strengthen the region's institutions through technical and management training, develop a constitutency for the concept of watershed management, and codify the basic data essential for project design and implementation. At no point is the proposed project redundant or in conflict with major donor efforts; on the contrary it is in complete support.

Since all other donors also work through national institutions, often the same ones as CATIE, their activities will benefit from this Project, especially from the training, the instructional materials and the data base. Project and watershed planning by any institution or donor will be facilitated by access to the project data base for obtaining background information and thematic maps and by drawing on CATIE's technical expertise. On the other hand, activities of other donors will be important sources for increasing information to feed into the data base and, over time, other donors are expected to finance technical assistance and training efforts.

IV. PROJECT DESCRIPTION

A. Goal, Purpose and Beneficiaries

Water is one of the region's most abundant and important natural resources, and its use must be effectively planned if the expected returns on present and future

investments in practically all sectors of the economy are to be achieved. The goal of the project is to protect the environment and conserve natural resources with special emphasis on maximizing the contribution of water to the social and economic development of the participating countries.

The various resources which make up watersheds are responsible for the natural protection and quality of water supplies. Thus, effective use of water must begin with the management of those resources. Given this basic tenet, the purpose of the project is to improve the institutional capacity in Central America and Panama for managing the region's watershed resources.

Due to its institution building character, the project will have direct and indirect beneficiaries. CATIE will improve its ability for providing long-term training in this critical field and will have the technical assistance outreach capacity to respond to country and donor needs. The national institutions will benefit from the expanded pool of expertise they can call on, as well as from an improved information base. National professionals and technicians will benefit directly from the major training component of the project, which is targeted at them. To a lesser but equally important extent the project targets training at decision makers and senior managerial professionals.

Benefits which will accrue to the region in an indirect fashion are expected to result from and to outweigh the direct benefits in the economic sense. Almost every sector in the economy will be an indirect beneficiary because by turning around the negative impact of uncontrolled deforestation and misuse of land resources, increased returns on investments will be achieved.

B. Project Components

Introduction

As described in the Project Background, the ROCAP survey revealed needs by the national institutions for long and short term training, technical assistance in the planning and management of watersheds, for more and better information on watersheds and their management, and for raising awareness of the benefits of watershed management among senior managers and decision makers.

Three basic project components are designed to address these needs: training, advisory services, and a support

component . The first two components include activities which address the more specific needs indicated by the survey consultant reports, and discussions with USAIDs regarding bilateral projects. The third component provides facilities at CATIE to support training and advisory services.

The components are presented in simple form by the following diagram:

Training	Support	Advisory Services
1. Graduate Program	Data Base	1. Ongoing, Long-Term Technical Assistance
2. Foreign Study Program		
3. Short Courses	Instructional Materials and Design	2. Short Term - Technical Assistance Jobs
4. Workshops and Seminars		3. Data Base Information & Assistance
5. Study Tours	Project Information Office	4. Instructional Design and Training Development Assistance

These components make up an outreach effort to address the technical needs of national institutions discussed in previous sections. Since the training and advisory services required by the countries involve common topics, such as planning for watersheds, the project is able to achieve cost-effectiveness by utilizing many of the same inputs for all components.

The most important of these inputs is the group of 12 specialists, who will act as professors or instructors in the training activities and will be the chief advisors in providing technical assistance. The array of expertise offered by the specialists* covers the needs expressed in the survey and other reports:

-- A watershed management specialist, a land use specialist and one shared assistant will address needs for planning.

* Detailed job descriptions are presented in Annex II-C

-- A soil and water conservationist, a hydrologist and a shared assistant will provide assistance in two technical areas requested by many of the national institutions.

-- A natural resource economist and assistant will provide important inputs for planning and will also play an important role in awareness and training activities which stress the economic benefits of watershed and natural resources management.

-- A data base management information specialist and assistant will make available important information required for the effective planning and management of watersheds.

-- An instructional design materials specialist and assistant will advise other specialists in the design of effective courses and provide them with relevant training material.

Of the specialists or senior staff, the project will finance five while CATIE will fund two. The five "assistants" (four financed by the project and one by CATIE) will be junior level professionals with M.S. degrees who will assist the senior staff during an intensive start-up period and will be trained on the job to assume overall technical responsibility. It is planned that they will gradually replace the senior staff over the life of the project and that CATIE will assume funding of one project-funded senior specialist (either the watershed management specialist or the soil and water conservationist) and of three project-funded assistants, leaving a permanent staff of seven in place when the project ends. The provision of a permanent capacity at CATIE to provide training and out-reach services in Watershed Management is the principal institution building aspect of the project. A description of the mechanisms by which CATIE will continue to fund personnel at the end of the project is presented in Annex II-B.

The project will also finance five country coordinators (Guatemala, El Salvador, Honduras, Costa Rica, and Panama) who will be the main links between the national institutions and the project staff at CATIE. CATIE will model their responsibilities and work along the lines of the country coordinators of the very successful Fuelwood project. For example, the Watershed Management coordinators will play important roles in arranging technical assistance requested by

the country and organizing in-country training events among many other tasks.

All of the above project staff are presented in this introduction because they will work in all of the components. For simplification, in the remainder of the Project Description they will be included only under the Training component discussion on inputs.

A mechanism that will also work with the implementation of all components will be the establishment of a national advisory committee in each country and of a regional advisory committee. The project will organize national advisory committees to meet on a quarterly basis. National committees will be headed by a senior ministry official or the director, deputy director or similar senior professional of the national natural resources management institution or forestry service. (In most cases the natural resources agency will serve as host institution for the country coordinator and function as the logistical center for carrying out the project). Other members will include a senior professional management representative from each of the other key primary and secondary institutions involved in watershed management. The country coordinators will act as advisors to these national committees. USAIDs will be invited to have representatives on the committee and, as appropriate, advisors and/or observers from other key bilateral or international donor organizations may be added.

The Regional Advisory Committee, to meet on an annual basis, will consist of the heads of national committees, the project manager, CATIE and ROCAP representatives, and, as appropriate, representatives from other regional institutions and donor agencies.

In general, the national advisory committees and regional advisory committee will review and advise on the project's operations and progress, on a national and regional basis, respectively. The committees will help the project staff to coordinate the project activities with national institutions.

1. Training Component

a. Description

The training component has three objectives: to expand and improve an indigenous training capacity in tropical watershed management at CATIE; to develop the

technical capacity of national institution staff to carry out watershed management; and to increase awareness of the benefits of watershed management at all levels of national governments. The following training activities are designed to achieve the objectives:

-- CATIE Graduate Program: A masters degree program at CATIE with emphasis on relevant, country-oriented thesis work, and a "visiting scholar program".

-- Foreign Study Program: A program of post graduate study at U.S. and Latin American Universities.

-- Short Courses: At least nine formal one to three week courses covering a range of watershed-related topics suggested by the ROCAP survey of national institutions to be carried out primarily in the countries.

-- Workshops and Seminars: Shorter events (a few days) to be held at the country and regional levels with the purpose of increasing awareness and appreciation for watershed management.

-- Study Tours: Field visits to watershed projects, technical sites, and international meetings.

Table 2 presents a summary of the Training Component.

1) CATIE Graduate Program

a) M.S. Specialization in Watershed Management at CATIE. The function of this activity is to develop a cadre of professional leaders trained in tropical watershed management at the masters level and above by establishing a comprehensive watershed management specialization within the existing M.S. program. The Department of Renewable Natural Resources (DRNR) at CATIE has provided a solid M.S. program in natural resources management for many years, including a few watershed management and related courses. Up to now, however, the very small number of academically trained watershed management professionals have received their education outside the region, principally in the United States. The establishment of a graduate specialization in watershed management in the DRNR at CATIE will not eliminate the need for this type of training, but it will enable more professionals to be trained within the region's tropical setting. This is important. First, an indigenous graduate program will keep professionals in the region and it will orient them to the

TABLE 2

SUMMARY OF TRAINING COMPONENT

Activity	Outputs
1. CATIE Graduate Program	. M.S. specialization designed and installed as part of existing DRNR M.S. program. . 30 Professionals complete M.S. at CATIE . 10 professionals complete up to 6 months as visiting scholars at CATIE
2. Foreign Study Program	. 2 professionals complete M.S. . 15 professionals complete post graduate study (up to 1 yr.) at U.S. and Latin American Institutions
3. Short Courses	. 10 short course modules developed, tested and improved . 380 National personnel trained
4. Workshops and Seminars	. 3 Seminar/workshop modules developed, tested, and improved . 200 national technical professional & policy level personnel trained . Computerized simulation presentations
5. Study Tours	. 30 National Personnel complete Study Tours.

specific watershed and natural resources problems of their own countries. (An outdoor laboratory/experimental watershed at the Rio Tuis watershed near CATIE will provide students with real on-the ground applications of their coursework). Secondly, the graduate program will be enhanced by being tied to the other training activities of the project in the region and to the current CATIE M.S. in natural resources management.

An illustrative course curriculum is presented in Table 3. The thesis work, planned for the last three quarters, will, in most cases, be related to a watershed located in the student's country.

Over the life of the project, thirty professionals will complete the M.S. at CATIE. The selection and supervision of these professionals will involve the project manager and other CATIE DRNR staff working closely with the country coordinators, national institutions and USAIDs.

b) Visiting Scholar Program. This low-cost but important program will be directed at Central American and Panamanian students who have recently earned M.S. degree in watershed management or other natural resources specializations from U.S. or other universities. Its objective is to orient them to tropical watershed management issues which are important to the region. Students will study programs approved by the project staff and which are oriented to solving country-specific watershed problems. Ten graduates will complete this program at CATIE for up to six months each.

2) Foreign Study Program

The objective of this program is to enable professionals who have M.S. degrees in watershed management or a related field or who have considerable experience in watershed management to benefit from additional, specialized training. Scholarships will fund post graduate training in the U.S. or in Latin America at universities or other training centers. A total of fifteen professionals will be trained for up to one year (average four months) in a specialized field in watershed management. In addition, two scholarships will be provided for complete M.S. programs at a U.S. university.

3) Short Courses

The short course program constitutes the project's most important outreach effort by responding to the need of national institutions to have personnel trained for

TABLE 3

ILLUSTRATIVE TWO YEAR GRADUATE
COURSE CURRICULUM

Quarter 1

Technical Writing

Scientific literature review

Mathematics

English

Physics

Principales of Watershed Management

Natural Resources Seminar

Quarter 2

Fundamentals in Tropical Forestry

Soil Science

Elementary Hydraulics

Statistics

Natural Resources Seminar

Quarter 3

Principles of Data Base Management and Computer Applications

Watershed Hydrology

Land use Inventory and Planning Techniques

Principles of Natural Resource Economics

Natural Resources Seminar

Quarter 4

Watershed Management planning & Application

Planning and Management of Wild Lands

Electives

Natural Resources Seminar

Quarter 5

(Literature Review and Preparation)

Thesis Seminar

Soil and Water Conservation

Quarters 6, 7 and 8

Thesis

short periods of time (one to three weeks). The short courses are also important for the identification of future candidates for other training activities, especially the graduate program.

This program builds on the considerable experience CATIE has gained over the years in carrying out short courses throughout CA/P (e.g., the Fuelwood and Small Farm Production Systems projects and a major program in wildlands management training). It is designed to match the various skill levels and needs of the target trainees. A set of nine topics considered important to improving technical skills of national personnel, increasing and improving the information base, and in generating more financial support for watershed management has been identified and is presented in Table 4. Although illustrative, it is planned that short courses from this list (as well as others as needs demand) will be given to national technicians and professionals.

The senior project staff will have major responsibility for organizing, preparing, and teaching the short courses in their area of expertise. Approximately forty percent of their time will be dedicated to this activity. When necessary, outside expertise will be provided by other CATIE professional staff or short-term consultants.

In general the courses will have a heavy practical emphasis and will be divided as follows:

- basic concepts and principles of the subject 25%
- basic techniques for treating problems 25%
- application: practical, hands on on exercise 50%

As appropriate, courses will be held near watersheds or other field sites, to accommodate the heavy emphasis on application. To do this, the majority of the courses will be held in the countries, and only a few at CATIE.

Courses will nonetheless be regional in nature, with roughly half of the participants from the host country and the other half from other countries. The regionality of the courses will result in both cost effectiveness and a sharing of experiences that will raise interest and levels of participation.

TABLE 4

TECHNICAL SHORT COURSES

Title	Outline of Topics	Participants	Duration
1. Data Base Management	Data Base Structure, information storage and retrieval	Country Coordinators, National Professionals	1 wk
2. Data Base Numeration	Use of Data Recording Forms, Entry of Data, Use of Micro-computer	National Technicians and professionals	1 wk
3. Curriculum Development	Watershed Science in Forestry and Natural Resources Programs	National University and Training School Profes-sionals	1 wk
4. Developing Instruc-tional Material Systems	Diagnosis of needs, method-ologies, options for instruc-tional materials	University and Technical School officials; national professionals	2 wks
5. Large Scale Integrated Watershed Planning	Inventory of resources, Watershed management eco-nomics, alternative solutions, field exercises.	National Professional and Senior Professional	3 wks
6. Watershed Planning, Programming and Imple-mentation	Watershed Resources, Problem/ Case Analysis, Program and Implementation Methods, Instrumentation and Conserva-tion Techniques.	National Technicians, Professionals and Senior Professionals	3 wks
7. Fundamentals of Applied Soil and Water Conserva-tion Technology	Soil Conservation Land Use Surveys, Terracing, gully erosion control	National Technicians and Professionals	3 wks
8. Project Proposal Prepa-ration	Writing, proposal formats of donors, Graphs and Tables, Budget Outlines, Executive Summaries	National Professionals and Senior Professionals	2 wks
9. Analysis and Evaluation of Watershed Projects	Monitoring, Evaluation of Plan Implementation, Economic Impacts, User Impacts	National Professionals and Senior Professionals	2 wks
10. Others			

Each course will accommodate approximately 20 participants and will be held an average of twice over the life of the project. Total participants are estimated at 380.

4) Regional Workshops and Seminars

Three types of workshops and seminars have been identified with the objective of promoting awareness of the importance of proper watershed management at the technical, professional, senior professional, and policy making levels. They will be held in the countries although with region-wide participation. The two to three day sessions each held two or three times over the life of the project will involve a total of approximately 200 participants.

a) Natural Resources Policy Seminar for Decision Makers

This workshop will be directed at the senior policy and senior professional levels from national public and private sector institutions. The seminar topics will include the role of soil and water policy in socio-economic development, resource conservation policies, alternative courses of action and their impact on individual countries and on the region as a whole. Field visits as well as audiovisual and computerized simulation presentations will be included to demonstrate economic/social implications due to poor or no watershed planning and management.

b) Senior Professional Basic Management Seminar

The function of this seminar is to enhance the management skills of the senior professionals and professionals who are responsible for directing watershed programs. During the workshop, participants will review their programs' progress, will plan for future stages of their programs, and will, as a group, coordinate inter-country collaboration.

c) Central America Watershed Management Workshop

The chief objective of this workshop is to review the "state of the art" of watershed management and to decide on future actions. The workshop will be held in the last year of the project. It will bring watershed specialists at the professional level together to review planning and

management methodologies, training progress, technical assistance and research and future priorities for all of these. The seminar will combine formal and informal exchanges and bring together professionals working on both upland and lowland tropical watershed management problems, and will be open to professionals from other than participating countries. In addition to professionals from key national institutions, participation will include USAID, ROCAP, CATIE and other donor representatives.

5) Study Tours

The objective of this activity is to instruct national personnel with direct observations of applied watershed management. It will be limited to thirty national participants at the technical, professional, and senior professional levels who will be identified by country coordinators and the project manager. In tours of up to 2 weeks, participants will observe field applications of watershed techniques in Central America, the Caribbean, and in some cases the United States and learn through on-the-job experience. They will visit watershed projects, including technical sites, consult with CATIE and national counterparts, and attend appropriate international meetings and conferences.

b. Implementation

The entire project staff, under the direction of the project manager, will be responsible for organizing the activities, designing training material with assistance from the instructional material and design specialist, and selecting participants from the countries. In this process the country coordinators will play an important role as the link between the project staff at CATIE, the national institutions, and USAIDs.

c. Inputs

The project will fund personnel costs of five senior specialists, four research assistants, one administrative assistant, five country coordinators, and short-term consultants. The project will also finance short courses, workshops and seminars, study tours and scholarships for 16 M.S. degrees, the post-graduate program, and the visiting scholar fund. Equipment to be funded specifically under this component include office and laboratory equipment and one vehicle for the project staff. The CATIE contribution includes 174 person months of international professionals, 141

person months of national professional personnel, and 168 person months of non-professional staff. CATIE will also provide scholarships for 14 M.S. students and approximately one fourth of total costs for workshops and seminars. CATIE's total contribution to the training component, including all personnel costs under training, is estimated at $1.173 million. Detail on project funded inputs and the CATIE contribution are presented in the financial plan and annex.

2. Advisory Services

a. Description

The objective of this component is to provide technical assistance at the request of the national institutions, in specific areas where capacity at the national level is weak. Sources for technical assistance in tropical watershed planning and management are presently very limited and expensive, and generally come from outside of the region. This component will build an in-house capacity at CATIE to offer expeditious technical assistance indicated by the survey in watershed planning, specific management areas, and information, including data collection management and analysis. The component will also offer assistance in the development and improvement of national training efforts.

Technical assistance will be provided chiefly by the same senior and junior specialists who will be teaching graduate and short courses. Over the life of the project the junior staff will be trained to assume the technical assistance function on a permanent basis.

The specialists will be assisted by short-term consultants and the country coordinators who, depending on their specific expertise will provide limited amounts of technical assistance. The country coordinators' main role under this component will be to work with national institutions and USAIDS to define technical assistance needs and then to arrange the appropriate assistance.

The component has been divided into four activities: 1) Ongoing Long-Term Technical Assistance; 2) Short-Term Technical Assistance Jobs; 3) Data Base Information and Assistance and 4) Instructional Design/Materials and Training Development Assistance. The activities are interrelated. For example, information provided by the data base will enhance the first two technical assistance activities, while experience from the technical assistance will provide

information for the data base. A summary of the component is presented in Table 5.

1) Ongoing Long-Term Technical Assistance

The function of this activity is to provide assistance in tasks that either involve a long process or must be monitored over a long period of time. In the ROCAP survey, national institutions identified technical assistance needs that are best provided on a comprehensive long-term basis. These fall under the general category of watershed planning. To meet this need, which will be based on thoroughly developed requests from the national institutions once the project begins, the project staff will provide long-term planning assistance and will develop at least one planning methodology which can be applied throughout the region at each of the following four levels:

-- Assistance in the strategic analysis, planning and prioritization of an entire national system of watersheds (policy matters may be included) including developing, testing, and improving a methodology to accomplish this.

-- Assistance in the detailed integrated planning of individual high priority watersheds, including international watersheds that are instrumental to the regional energy grid system.

-- Assistance in the implementation of detailed management techniques (operational planning) of individual priority watersheds.

-- Assistance in both planning and implementation at smaller scale levels, i.e., smaller watersheds or the individual production units (farms) in order to develop methodologies and demonstration units.

It is expected that at least five bankable watershed management plans with funding proposals will result from the latter three levels of assistance.

In addition to planning assistance, this activity will provide assistance to evaluate on-the-ground integrated watershed management practices in at least two national projects and to design and establish at least two adaptive research programs in selected watersheds.

TABLE 5

SUMMARY OF ADVISORY SERVICES COMPONENT

Activity	Outputs
1. Ongoing Long-Term Technical Assistance in Watershed Management	. Watershed Management Methodologies established at 4 levels . 5 bankable watershed management plans, including plans for international watersheds, developed and funding proposals prepared. . Improved integrated watershed management practices evaluated on-the-ground in at least 2 projects. . Research programs designed and established in at least 2 projects
2. Short-Term Technical Assistance Jobs in Watershed Management	. 60 T.A. assignments completed (average 2 weeks each)
3. Data Base Information and Assistance	. National Da a Base System established and/or improved . Information provided through simple request forms
4. Instructional Design/ Materials and Training Development Assistance	. Training/Curriculum Development of National Institutions improved in several countries. . Plans for long-term curriculum development including funding proposals prepared for 2 national training institutions

2) Short-Term Technical Assistance

In this activity project staff will provide short-term technical assistance in specific tasks in the solution of planning, organization or technical watershed problems as requested by national institutions. Examples of short-term technical assistance to be provided are:

-- advice relating to technical interventions such as flood control, prevention of siltation of reservoirs, and the establishment of hydrometeorological networks.

-- assistance in the design of specific national training activities.

-- assistance in the design and development of technical guidelines and field handbooks.

-- assistance to USAID's and donors in the design and evaluation of watershed projects or watershed components of other projects.

-- advice to improve the organization and administration of national watershed management institutions.

-- assistance for specific policy and/or legal studies requested by national institutions and governments.

The latter two will be very closely coordinated with USAIDs to ensure consistency with bilateral efforts.

Over the life of the project, it is expected that approximately 60 short term technical assistance assignments averaging two weeks each will be provided.

3) Data Base Information and Assistance

The objective of this advisory service is two-fold: to provide national institutions with information for watershed planning and management; and to provide national institutions with technical assistance in the collection, analysis, and utilization of watershed information. To accomplish the objectives, the data bank staff at CATIE will have the following functions:

-- train country coordinators in data collection, editing, processing and retrieval.

-- respond to information requests by countries.

-- advise countries on data collection needs and help coordinate collection efforts.

-- develop uniform data recording forms and train country personnel in use of forms and data entry.

-- advise national institutions on the organization of data bases in research fields important to watershed management.

-- advise on the establishment or improvement of in-country information storage and retrieval systems.

4) Instructional Design/Materials and Training Development Assistance

The function of this activity will be to provide technical assistance in curriculum design to universities, technical schools, and national institutions which have watershed management or natural resources training programs. When appropriate, training materials developed for short courses will be provided to those national institutions for use in their training programs.

b. Implementation

Identification and provision of short-term advisory services will be organized and controlled by the use of simplified request forms to be distributed, collected and forwarded to CATIE by the country coordinators.

Services will be provided primarily by the project staff although, in some cases, coordinators may be able to provide the needed assistance. When necessary, short-term consultants will be contracted. To make the activity more effective, a computer roster of watershed and natural resources personnel will be maintained in the data base. The roster, by including the special skills of national professionals and technicians, will encourage the use of locally available talent.

The specific activities which make up the Ongoing Long Term Technical Assistance, i.e., the development

of planning methodologies, bankable plans, the design and implementation of adaptive research programs, and the evaluation of watershed management programs, will require a thorough identification and selection process that includes careful consultation among the project staff, national institutions, USAIDs, and other donors.

The national advisory committees, described in the Introduction to the components, will facilitate this type of consultation. The advisory committees, both on a national and regional basis also will serve to keep donors informed about the project in general and to promote their consideration of bankable plans and funding proposals.

c. Inputs

In addition to the staff already described under the training component, the project funds for this component will finance travel and per diem, field equipment and tools, vehicles and special field research inputs. The CATIE contribution to this component includes funding of travel and per diem costs, several vehicles, and maintenance and operation costs of vehicles and other equipment. The total estimated value of this contribution is $78,000. For details on project inputs and the contribution by CATIE see the Financial Plan and Annex.

3. Support Component at CATIE

a. Description

The support services consists largely of facilities that will be put in place at CATIE to support training and advisory services. The three facilities are: the Data Base, the Instructional Design and Materials Office and the Project Information Office. A summary of the support component is presented in Table 6.

1) Data Base

To provide relevant, up-to-date information for the training activities and for advisory services to countries, the following systems will be established in the Data Base at CATIE:

-- Computerized Reference Library: Collection of all known documentation relating to watershed management in Central America and Panama, and key documentation from the other tropical areas as well as the principal texts and journals in the field.

TABLE 6

SUMMARY OF SUPPORT COMPONENT
(AT CATIE)

Activity	Outputs
1. Data Base	. Computerized Reference Library . Map and Photo Collection . Geographic Data Base System . Watershed Management Descriptive Tables . Simulation Programs
2. Instructional Design and Materials	. Short Course and graduate course materials . Seminar and Workshop Materials . Audio Visual Productions
3. Project Information Office	. Press Releases . Regional Newsletter . Articles and Letters to professional journals . Displays and Demonstrations

-- Map and Photo Collection/Geographic Data Base System: a regional collection which will utilize the CRIES system for rapid production of maps and related digitized data.

-- Watershed Management Descriptive Tables

Examples are:

. Index to Maps and Photos

. Tabular Description of Priority Watersheds

. Land Utilization Classes

. Watershed Management Techniques Inventory

. Follow-up/Evaluation of Training participants

2) Instructional Design and Materials Office

In cooperation with other project staff specialists, the Instructional Design and Materials Specialist and his staff will produce short course and graduate outlines, text materials, audio visual material for all training activities. These will be based on needs and objectives determined with other specialists and by surveying national institutions.

Over the years CATIE has developed a capacity for instructional materials development under its current graduate and short course programs, including basic equipment. To meet the demands of this project, the current capacity will be expanded with the purchase of a limited amount of equipment. However, to minimize equipment needs at CATIE, appropriate production tasks will be contracted to outside sources.

3) Project Information Office

In the Fuelwood and Small Farm Production Systems projects, valuable time of technicians has been taken up by responding to inquiries. The Project Information Office of this project under the Instructional Design and Materials Specialist will centralize responding to inquiries and will free up project staff time for implementation. It will also carry out awareness activities to promote watershed management

in general, and to provide the public with information on the project, in particular. Informational and promotional material to be distributed for the above purposes will include: newsletters, brochures, articles for magazines and journals, press releases and audio visual presentations.

b. Implementation

The Data Base will utilize the existing Computer Center at CATIE. The Data Base Specialist will begin collection of data with the establishment of the Computerized Reference Library. Country coordinators will collect data at the country level by distributing simplified data collection forms to national institutions. Country coordinators and national counterparts will be trained in all phases of data collection by the data base specialist.

The Instructional Design and Materials Specialist and his office, in cooperation with the entire project staffing, will initially identify needs for instruction, conduct audience analyses for instructional material design, and define performance objectives with instructors. Based on these preparatory tasks, appropriate instructional materials will be either produced or acquired and modified, as necessary.

The same specialist will prepare press releases for major national newspapers to inform the public about the project and will answer inquiries as they arise. This specialist will also cooperate with the other specialists in preparing materials for raising awareness in connection with seminars and workshops and will work closely with all project staff, especially country coordinators, in identifying and meeting opportunities for promoting watershed management.

c. Inputs

In addition to the Data Base and Instructional Design and Materials Specialist and a professional assistant for each already listed under training inputs, the project will also fund the purchase of a limited amount of computer and instructional material production equipment, audiovisual and office supplies. (These items are described in detail in the Financial Plan Annex). CATIE's contribution to this component includes office and teaching space, laboratory and audiovisual equipment, vehicles, photocopying, printing and reproduction of educational materials, and telephone and telex costs. This contribution is valued at $198,000.

C. Summary Financial Plan

The proposed budget for the project is $8.856 million of which ROCAP's contribution will total $6 million (68%), CATIE's $1.5 million (17%) and Host Governments' $1.3 million (15%). Table 7 contains a summary of the project budget showing each component and the funding source.

Project funding will cover activities planned over the implementation period of five years from January 1984 through December 1988. Table 8 shows the expenditure schedules for the ROCAP contributions over the five years of implementation of the project. Table 9 shows the projection of expenditures of the ROCAP contribution by major component and by year. Further detail on the budgetary contributions by each of the various funding sources and for each of the cost components, with detailed explanations of calculations is found in Annex II-D.

TABLE 7

FINANCIAL PLAN PROJECTED COSTS
(US$000)

Project Element	ROCAP	CATIE	Host Govt.	TOTAL
Personnel Costs	2,175	984	423	3,582
Training	1,155	190	739	2,084
Travel & Per Diem	305	33	41	379
Equipment	414	198	100	712
Other Costs	830	55	93	978
Evaluations	100	-	-	100
Overhead	732	-	-	732
	5,711	1,460	1,396	8,567
Contingency	289			289
	6,000	1,460	1,396	8,856

TABLE 8

ROCAP'S CONTRIBUTION

ESTIMATED PROJECT EXPENDITURES BY YEAR
(US$000)

Years	
1	610
2	1,251
3	1,435
4	1,519
5	1,185
	6,000

TABLE 9

ROCAP'S CONTRIBUTION
PROJECTION OF EXPENDITURES BY SPECIFIC INPUT
AND BY YEAR
(US$000)

	TOTAL	YEARS 1	2	3	4	5
Inputs						
Personnel	2,175	160	457	544	603	411
Training	1,155	39	174	317	351	274
Travel & Per Diem	305	26	47	88	90	54
Equipment	414	185	217	11	1	-
Other Costs	930	94	141	233	212	250
Overhead	732	76	155	173	189	139
	5,711	580	1,191	1,366	1,446	1,128
Contingency	289	30	60	69	73	57
TOTAL	6,000	610	1,251	1,435	1,519	1,185

V. IMPLEMENTATION ARRANGEMENTS

A. Administrative Arrangements

1. Role of CATIE

CATIE, through the Department of Renewable Natural Resources (DRNR), will have overall responsibility for project implementation. The project will initially be placed within the existing Wildlands and Watershed Management Program. After the project is signed, CATIE will present a reorganization plan for DRNR as part of meeting the condition precedent of submitting a detailed work plan for the first year of the project. The Project Manager, who will report to the director of DRNR, will supervise all staff assembled for the project. The activities of each component will be coordinated by the Project Manager, as will the work of the country coordinators. The relationship between the country staff and the Project Manager will be a key element in ensuring that the project provides effective outreach to national institutions. Finally, the Project Manager will serve as the contact for ROCAP staff on all implementation matters.

2. Role of ROCAP

ROCAP's General Development Office will have primary responsibility for managing the project. The Regional Environmental Management Specialist (REMS) assigned to that office will serve as the project technical coordinator with day to day responsibility for monitoring implementation status. The REMS will maintain close contact with the CATIE Project Manager on all aspects of the project.

Within ROCAP, an implementation committee has been established with representatives from the Program and Project Development and the Controller's offices. As needed, they will assist the GDO and REMS in addressing any implementation issues that may arise.

From its experience with other ROCAP projects, CATIE is familiar with the general administrative requirements, such as progress reports and financial controls, which the Mission establishes, and has demonstrated its capacity to comply with them. In light of this experience, no administrative problems are anticipated.

B. Implementation Plan

It is not uncommon for projects to suffer from delays in initiating implementation of planned activities. This has been the case in several ROCAP projects, where attempts to concurrently recruit personnel, procure commodities, establish logistics for activities, etc. have fallen behind, making it difficult to keep within the original schedule of project implementation. The Agency's Implementation Task Force apparently observed similar problems in other Missions, and is considering recommending that an initial start-up period be planned to take care of administrative and logistical matters prior to beginning actual implementation. ROCAP and CATIE have agreed to adopt such an approach for this project. Accordingly, the first 6-8 months following signature of the Project Agreement will be devoted to those efforts. ROCAP staff, supplemented by contractors where appropriate, will be available to assist CATIE as needed.

An important element of the project will be the provision of on-the-job training for the junior staff who are intended to take over technical responsibilities from the senior advisors by the end of the project. The timing of the training and replacement has been planned over a period of three to four years to allow for a gradual transfer of responsibility.

The ability of CATIE to respond to the needs of the national institutions will be a key to the long-run success of the outreach mechanism this project will help to strengthen. For this reason, project activities will be programmed carefully and institutional linkages will be created by having a professional country coordinator in each of the participating countries. Also, in order to avoid stretching resources too thin at the outset, technical assistance activities will initially be focused on only three countries: Panama, Costa Rica and Honduras. These countries are the most active with projects which involve watersheds, and where the services of this project will be particularly timely and complementary.

The schedule of all major events as they are currently planned over the life of the project is contained in Annex I. The project staff will, however, update the schedule each year as part of the annual work plans they will prepare. Changes will be based on progress to date and take into consideration any factor which is not foreseen at this time. Workplans developed at the national level will be coordinated with the USAIDs.

C. Evaluation Plan

As project implementation moves forward, it is anticipated that problems and needs for modifications will emerge. Regular monitoring and evaluation will have an important role in the identification of those problems, and the project plans two levels of reviews to maximize their imput to the achievement of project objectives.

Two formal evaluations, involving ROCAP and CATIE staff, supplemented by one or two independent consultants, will be conducted to examine the progress of activities under each component, the appropriateness of the training being provided, the effectiveness of the country coordinators, the extent to which national institutions are looking to CATIE for technical services, and the management of the project. These evaluations are tentatively scheduled for March 1985 and June 1986.

Complementing these evaluations will be annual evaluation reports provided to ROCAP by CATIE. The reports will cover all major activities and accomplishments, including actual versus planned progress; factors affecting implementation; financial status; and, based on these, recommendations for activities during the next year. The CATIE Project Manager and senior project staff will be responsible for designing the monitoring system that will result in these reports being completed and ensuring that they provide information that will be useful in assessing progress and, as appropriate adjusting the content and focus of the different components. ROCAP will review and approve the system when it is developed and prior to its being put into effect.

A final evaluation will be conducted toward the end of the project (August 1988). It will be carried out by an independent consultant team and will focus on an assessment of the overall success of the project. To do so, regional and country level developments, problems and accomplishments will be examined.

D. Procurement Plan

CATIE will serve as its own agent for the procurement of goods and services required for the project. From its experience with previous ROCAP projects, CATIE is familiar with AID procurement regulations and, with limited assistance from ROCAP, has the capacity to carry out the planned procurement activities.

1. Technical Services

Long and short-term services will be procured for the project. To satisfy these needs, CATIE will contract individually for each position. This is its normal practice and offers a large pool of potential candidates from which to draw.

The long-term requirements consist of two parts: senior staff, and junior staff and country coordinators. Some of the senior staff must be recruited from outside CA/P because few individuals with sufficient expertise are available in the region. It is expected that of the five project-funded positions, some, but perhaps not all, will be filled from the U.S. As a result, it may be necessary to recruit certain members of the senior staff from other LAC or Code 941 countries. If so, a request for 941 waiver and justification will be submitted to AID/W.

To recruit for these staff positions, CATIE will place announcements in newspapers and technical publications; utilize contacts in national and international institutions; and the USAIDs to identify potential candidates. Scopes of work (see Annex II-C) will be provided to all interested individuals. After reviewing each application CATIE will hire the most qualified individual for each position.

2. Commodities

Project financed commodities will be purchased by CATIE following the guidance provided in Handbook 11. Most of the project commodities will be purchased in the United States. Some, however, may be bought locally in the CA/P region. The detailed Financial Plan (Annex II-D) contains a list of the commodities needed to support the training and support services to be provided by the project. This includes computer equipment (digitizer, expanded storage and drive) designed to upgrade and expand the data processing capacity at CATIE in order to meet the requirements of the project, M/SER/DM will be asked to review and approve the specifications prior to its procurement.

E. Disbursement Procedures

No deviation from established AID disbursement procedures is anticipated. Funds will be disbursed to CATIE

upon presentation of monthly vouchers in the required format indicating expenditures made in conformance with the financial plan of the project. As described above in the Implementation Plan, updated annual work plans will be required. These will serve as a basic guide to control the flow of project funds.

F. Waivers

It may not be possible to recruit all of the senior staff from Central America/Panama and the U.S. If so, a request for a Code 941 waiver and justification will be submitted to AID/W.

G. Conditions, Covenants and Negotiating Status

1. Conditions Precedent to Disbursement

a. First Disbursement

The standard conditions precedent to initial disbursement of the grant will apply, including the designation of official representatives for CATIE, and the provision of specimen signatures of the representatives. An additional condition precedent to initial disbursement will require CATIE to submit a detailed workplan for the first year of the project.

b. Second Disbursement

Prior to disbursement of funds for activities in any of the countries of Central America and Panama, CATIE will execute letters of agreement with the primary natural resourse institution of each eligible participating country, outlining CATIE and national institution roles, establishing working relationships between CATIE country coordinators and national institutions, and identifying national inputs to the project.

2. Covenants

a. Fees and Project Reflows

CATIE will covenant that all fees for services provided under the project will be used to finance costs related to the project.

b. Other Services

CATIE will covenant to provide facilities, support, and data services equivalent to counterpart values estimated in the budgets of the project agreement.

CATIE will agree to provide appropriate housing for the long-term advisors funded under the project.

c. Project Coordination

CATIE will covenant to coordinate project activities with USAID missions in each country.

d. Workplan and Budget

Prior to undertaking project activities each year after the first year of the project, CATIE will furnish in form and substance, satisfactory to AID, a consolidated workplan and budget for activities for that year.

3. Negotiating Status

This project has been developed in close consultation with CATIE. CATIE is very knowledgeable of all aspects of the proposed activities and of the contents of the project paper.

The application of the Brooke/Alexander Amendment to Nicaragua was reviewed by ROCAP with the LAC/GC during the course of the project design and, based on the finding that this legislative restriction applies to Nicaragua, said country has not been included among the countries that will participate in the project. CATIE is fully aware that Nicaragua has been excluded and that no project funds can be used to provide assistance to Nicaragua.

ROCAP believes that all issues have been discussed and resolved in the design process, forsees no problems in the negotiation of the Grant Agreement with CATIE and expects that it can be signed within one week of authorization.

VI. SUMMARY PROJECT ANALYSIS

A. Technical Analysis

The rationale for the project focusing on training, advisory and support services has been discussed in Sections II and IV above. This analysis reviews the technical factors associated with the design of the proposed project and the approach selected for its implementation. An expansion of the technical rationale of the project is provided in Annex I-F.

Watershed degradation is a major factor contributing to environmental deterioration as well as impacts that seriously hamper the economic feasibility of numerous infrastructure and development projects related to water and related resources in Central America. One example of this is

the premature siltation of hydroelectric reservoirs which reduces the economic return of these projects and the options to develop future hydroenergy sites which, if not corrected, may force the region to continue to depend on costly imported petroleum to meet its energy demands. The impact on other sectors related to soil erosion, flooding, and loss of water supplies makes the need for improved watershed management (see Annex I-E) even more obvious.

Based on the results of consultations with international, regional and national organizations, consultant reports from CA/P experts, the opinion of experts from USDA/OICD, as well as a survey of regional and national watershed management problems and needs (in conjunction with CATIE and USAIDs), and with assistance from AID/W and ST/FNR, ROCAP determined that:

- there are a number of common problems and a regional solution to those problems;
- there is a competent regional institution technically qualified and commited to work with national entities;
- that the problem to be solved is of high priority in the bilateral strategies of the country Missions;
- that a national delivery system exists;
- that a joint regional/national combination of efforts is feasible and cost effective; and
- as designed, the project does not duplicate or bypass national institutions set up but rather supports them in their key areas of weakness.

Through interviews and visits conducted as part of the intensive review and project design work, a strong willingness on the part of the national institutions to begin addressing the problem in a more adequate manner was identified.

The project will not involve new complicated, and difficult research activities. Rather, the project will be a regional effort to apply technologies (agroforestry, silviculture, farming systems) developed over the years at CATIE in combination with individual watershed management technologies that have been already successfully applied (pasture improvement in Panama, upland soil conservation practices in El Salvador, etc.) What is lacking and what the

project will provide is a region-wide program that applies all of these known technologies in an integrated and systematic manner. This will be made possible by the installation at CATIE of a team of specialists that covers all of the essential technologies of integrated watershed management.

In general, the technologies that will be used are not complex and are easily understood and accepted by national institution personnel. Sometimes the project will result in transferring technologies proven in one country to other parts of the region.

The approach selected for the project is to provide a select yet integrated set of component services to the key water resources institutions that will lead to permanently strengthening CA/P resource management and protection capabilities. A major training effort oriented toward professional and technical personnel will provide opportunities for graduate degrees as well as in-service training and task-oriented workshops, seminars and technical meetings. Advisory services will be provided to meet short-term technical assistance needs for ongoing projects, and to assist by putting in place improved country-level data base/information systems and instructional materials and training programs/curricula. Support services in areas where the majority of the national institutions are weak and in need of assistance, will also be provided. CATIE-based instructional design and materials and data base facilities will provide needed information and materials to strengthen natural resource management and protection decision-making.

In addition to the CATIE central staff of seven senior specialists (five funded by the project), country coordinators will be placed in the principal national natural resources institutes with responsibility for watershed management in the countries. These coordinators will serve as the linkage between the regionally provided services and the country level programs and will promote and facilitate the design and provision of training, advisory and support services in their host country. This approach has, through the experience of other CATIE regional projects, proven to be both effective and critical to the success of the technology transfer and national institutional building process.

In limiting the scope of the project to the proposed components, other possible activities such as baseline (policy and finance) studies, large-scale demonstration/pilot activities and the intensive use of foreign training and advisory services, have been excluded. The high cost, inappropriateness as regional activities and/or the relatively

low benefits to be derived to the countries of such activities led to this decision. Similarly, a previously anticipated direct participation of the regional institutions SIECA and CRRH was dropped because of the obvious advantage in expertise of CATIE as well as a desire to keep the project relatively simple and operational. Instead, linkages will be promoted between CATIE and these organizations as well as with the two other regional schools ESNACIFOR and ERIS, through their participation in the national and regional committees described in the Project Description and Institutional Analysis sections of this paper.

As designed, therefore, the project takes into consideration the availability of known technologies and institutional capabilities at both the regional and national level. Confronting the most serious constraints identified, the project seeks to improve and increase human resources and institutional capacities in watershed management throughout the region. Consequently, after reviewing the above factors, the project committee has determined that the proposed design is technically responsive to the problem identified and that no technical constraints exist, which will impede the successful implementation of the project.

B. Institutional Analysis

This section provides a summary description of the institutions involved in the project, an analysis of how they will contribute to the project goal and purpose and how institutional deficiencies will be resolved. A detailed institutional analysis of CATIE including its history, physical plant, organizational structure and limitations, has been included in Annex I-G.

1. Tropical Agricultural Research and Training Center (CATIE)

CATIE is a regional center dedicated to agricultural and animal sciences, forestry development and natural resources conservation for the tropical areas of Latin America, especially those of the Central American Isthmus and the Caribbean. Its Department of Renewable Natural Resources (DRNR) will have primary responsibility for implementing the project.

Constituted as a non-profit organization, CATIE was created in 1973, following the joint efforts of the Government of Costa Rica and the Interamerican Institute for Cooperation on Agriculture (IICA) of the Organization of

American States (OAS). Currently Panama, Nicaragua, Honduras, Guatemala and the Dominican Republic are members and negotiations have been concluded with El Salvador which will permit its membership.

As a non-profit research/training institution, CATIE relies on contributions from member countries, IICA and the international community in general for the bulk of its core budget and operating funds. The only income which is not donated is that which comes from limited commercial farm operations carried out on part of its lands and from other assets such as rental of residences and seed bank sales. However, that income cannot be heavily relied upon because it is relatively small and a significant percentage of it comes from export crops (coffee and sugar), for which the price fluctuates considerably over short periods of time. A large portion of CATIE's administrative expenses, therefore, are funded through overhead charges on the projects it implements for donor organizations.

2. Department of Renewable Natural Resources (DRNR)

Forest Sciences as a discipline of CATIE dates back to the founding of the Inter-American Institute of Agricultural Sciences (IICA) at Turrialba, Costa Rica in 1942. A department existed first as part of IICA and, since the 1973 creation of CATIE, as part of that institution. The department's early work was concentrated largely on trees for timber production. It also initiated work in the ecological characterization of the region and was the first M.S. forestry school in Latin America. It currently provides training in short courses and at the M.S. degree level in such areas as agroforestry, forestry management, silviculture and resource conservation.

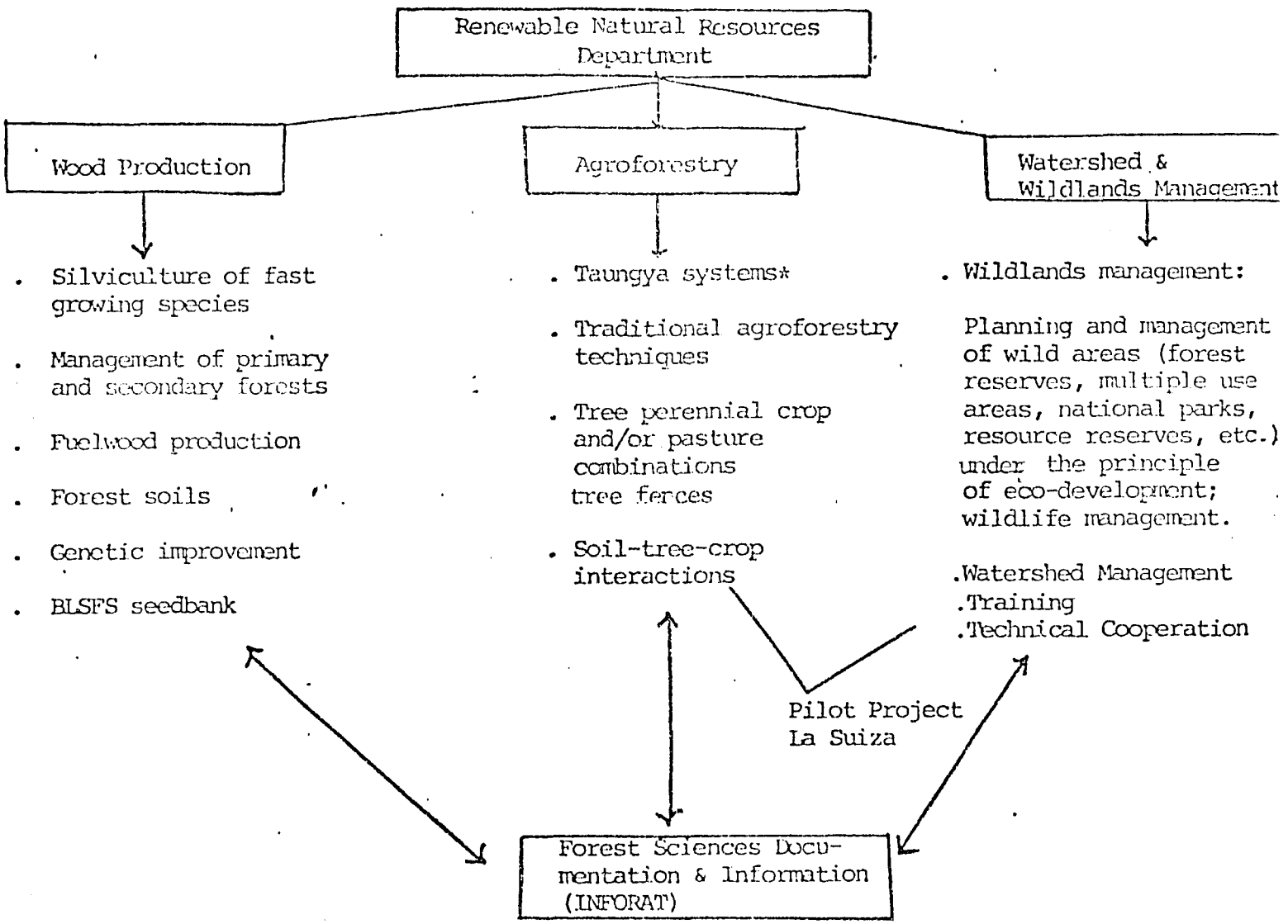
Since the creation of CATIE, the DRNR has expanded into agroforestry, wildlands and wildlife conservation, and most recently watershed management, fuelwood production, and small farm agroforestry and silviculture (see figure 1 for the current structure of the department). All of these areas are interrelated and will directly contribute to the project.

Some important characteristics of CATIE's, and the DRNR Program include:

-	Students on campus:	150
-	Yearly intake:	About 50
-	Total Number of CATIE professors:	About 80
-	Scientists/Profesors within DRNR Programs:	10-12

CATIE - DEPARTMENT OF RENEWABLE NATURAL RESOURCES

(Current Structure)



* An agroforestry system, developed in Africa and applied in Latin America, which involves gradual transition from annual crops to total forest.

3. Wildlands and Watershed Management Program

Wildlands and Watershed Management (WWM) was added as a program to the Renewable Natural Resources Department in 1977 with funding for personnel and operations provided by the Rockefeller Brothers Fund. Since late 1979, the Wildland sub-program's small staff of two specialists has been funded by CATIE's core budget. The Wildlands sub-program has been very successful at obtaining small amounts of operational funding for its work in Central America and Panama, with individual "on-the-ground" projects in each country and frequent regional and national training events. Project funding has been received from USAID/Costa Rica, USAID/Panama, FAO, Interamerican Foundation, IUCN, Kellogg Foundation, DDA (Swiss Development Assitance), RARE, UNESCO, U.S. Natinal Park Service, U.S. Fish and Wildlife Service, and World Wildlife Fund (WWF).

The Wildlands program's forte is working closely with national governmental resource management institutions, particularly interinstitutional-interdisciplinary teams, and in some cases national or local private citizens groups and/or universities, in the following major areas:

-- Preparation and implementation of plans and strategies for wildland/watershed* areas and national systems;

-- Development, testing and improving a variety of practical training forms and methods and the training of large numbers of natural resources professionals, technicians and support personnel in regional and national level training events (mobile seminars and courses, short courses, in-service training, M.S. education, etc.), particularly using pilot projects as training sites;

-- Increasing communication and collaboration between the resource management agencies in the region by acting as a liaison and clearing house for them; and

*It should be emphasized that wildlands is used by WWM in the broad international definition of the term and includes a wide range of management categories such as national forests, multiple use areas, water production reserves, national parks, biosphere reserves, wildlife refuges, hunting reserves, anthropological reserves, etc.

-- Increasing the shared use of human resources between the countries (consultants from within the region, in-service training in national institutions, etc.)

The Watershed Management portion of WWM has continuously suffered from a lack of human resource capacity and external support, although the close relationship of watershed, multiple-use and wildland management has been recognized since the start. From 1977 until early 1981 WWM employed a part-time watershed specialist to teach M.S. level courses, guide M.S. student thesis investigations and develop a few regional seminars and training events, but his time was severely limited.

From early 1981 until September, 1982, no watershed specialist was at CATIE. Recently a Hydrologist - Watershed/Natural Resources Planning and Management Specialist was added with AID/W support. Over the period of September 1982-September 1984, that individual has the task of teaching M.S. courses, conducting short-term regional training events, guiding M.S. graduate student research, developing a pilot watershed management project called La Suiza near CATIE, and providing technical assistance to meet needs in the region. CATIE has agreed to assume the costs of this position, and it is contemplated that this watershed specialist will form part of the CATIE contribution for this project.

4. A Strengthened Program in Watershed Management

This project will build upon much of the valuable expertise and linkages already established through the Wildlands program in order to develop improved watershed management capabilities in the region.

The historical weakness in the human resource capacity of the Watershed program will be addressed in two ways: first, the project and CATIE will fund a team of seven senior personnel (five will be funded by the project, two by CATIE) to provide an immediate source of expertise for training and technical assistance; and, second, the senior staff will train and gradually be replaced for the most part, by a core of junior staff (also project funded) who will emerge at the end of this project as the senior watershed specialists in Central America. Their in-depth understanding of tropical forest influences, their knowledge of management and planning problems, linkage to public and private agencies throughout the region and knowledge of technologies available from other parts of the world for meeting the watershed needs in this region will place CATIE in a unique positon to respond to the area's water resources

problems. The availability of this staff of experts is expected to generate an increase in demand for their services and permit CATIE to retain them as permanent members of its staff (see Annex II-B).

In addition to the establishment of a regional core of experts, one of the most important contributions of this project will be the linkage developed between national public and private forestry agencies, water resources user institutions, and CATIE. The return of M.S. watershed management graduates from CATIE and the U.S. to their own countries as well as the short course participants will contribute to the demand for CATIE services in assisting the region to more fully utilize its natural resource potential.

5. National Institutions

Several studies, as well as a regional watershed management survey (see Project Background, Statement and Analysis of the Problem and Annex II-F), were carried out by ROCAP to provide the background information for the preparation of this project. These studies reported on common deficiencies restricting the capabilities of national governments to properly manage their watersheds, which can be summarized as follows:

- A chronic lack of human resources necessary to plan and manage the watershed resources.
- Weakness or total absence of an appropriate education structure to provide training in watershed resources management.
- A failure to link watershed management problems to the development of the countries.
- Weak regional channels of communication.
- No diagnosis of the situation on which to base priorities for watershed management.
- Very limited or no experience in watershed management at the various institutions.
- Lack of understanding among the political and high level decision makers about the magnitude of the problem.

- Discrepancies and weaknesses in the legal/policy base that delegates management responsibilities to the different national institutions.

In order to help counteract these deficiencies, the project has developed as a central element of its design an outreach strategy to deliver technical resources and services. At the national level, it is expected that the natural resources agency will serve as the host institution for the country coordinator and function as the logistical center for carrying out the project and providing services to benefit other national institutions working the field of water resources. Training and support and advisory services to be provided to other institutions -- principally the electrical institutes, the potable water supply and sewage agencies, the universities and educational centers, the national planning offices, and others as appropriate -- will be coordinated by the country coordinator.

The principal national institutions that will participate in the project are discussed in depth in the Detailed Institutional Analysis, Annex I-G.

C. Financial Analysis

1. Financial and Administrative Viability and Capability of CATIE

As a non-profit organization, CATIE's objective is to match income with expenses while maintaining its ability to provide services to the region. Prior to 1981, CATIE continuously fell short of that objective and was often forced to operate through deficit financing. The result was a shaky financial picture which threatened the ability of the institution to function.

Beginning with the arrival of a new administration in 1981, CATIE placed top priority on improving its financial situation. A first step was to embark on an austerity program in which expenditures were reduced to a minimum while measures to control long-term costs more effectively were studied. In addition, ROCAP contracted with the local Price-Waterhouse firm to conduct an exhaustive review of the financial and administrative mechanisms at CATIE. A series of recommendations made by Price-Waterhouse have been instituted, and a new set of procedural manuals have been developed and accepted by CATIE. Also, CATIE now has an Administrator on the staff whose primary function is to oversee the financial operations of the institution.

Due to the sound policies instituted by the current administration, CATIE's 1982 Statement of Income and Expenses shows an excess of income over expenses in 1981 and 1982, with the deficits from previous years completely eliminated (see Annex II-D, Financial Analysis, for details). This impressive financial performance can be expected to continue in the future and become more fully institutionalized once the manuals developed by Price-Waterhouse are put into use.

In addition to these efforts, the financial analysts on ROCAP's staff periodically visit CATIE to review matters related to the financial status of our projects as well as other financial matters which may arise. As a result, ROCAP is completely current on the financial situation at CATIE and can state that CATIE has adequate accounting systems, sufficient administrative expertise and financial capability to undertake the proposed project.

2. Budgetary Analysis

CATIE relies on quota payments from member countries ($250,000 per year), from an annual contribution of $750,000 provided by IICA, and from the international community in general for the bulk of its core budget used for operating funds. The only income which is not donated is that which comes from the sale of output of the small commercial farm on part of CATIE's lands and from other assets such as rental of residences and seed bank sales. However, that income cannot be heavily relied upon because it is relatively small in the first place, and, secondly, a significant percentage of it consists of export crops (coffee and sugar) for which the price fluctuates considerably over short periods of time. As a consequence, CATIE does not have a fixed minimum, guaranteed annual core budget as do national governmental institutions.

Without a fixed income, CATIE must maintain its administrative expenses at the lowest possible level consistent with normal day to day operations. As part of its financial, accounting, and administrative reorganizations, CATIE has succeeded in its efforts to lower those costs. Concurrently, CATIE is enforcing the payment of an overhead fee on projects and contracts which require administrative and logistic support. This is an important step in CATIE'S efforts to improve its financial status since, in 1982, approximately 67% of its total income came from contracts for project specific activities. Prior to the decision to enforce overhead fee payments, many projects contributed a very small amount for such support, forcing CATIE to exhaust its relatively small and fixed

income to provide it. In effect, CATIE was spending funds it did not have to support project activities.

In 1982, based upon an analysis of project support costs, CATIE's Board of Directors estabished a minimum overhead figure of 15% to be charged to all projects. Previously, though it was CATIE policy, it was not a requirement. It is still probable that 15% is insufficient to cover actual costs incurred. In order to set a minimum rate which is more appropriate, CATIE is currently taking steps to document that the real "overhead" costs are higher. In the last two years, a number of donor agencies have agreed to raise their contributions in terms of overhead to 20-25% of project costs.

In summary, the recent positive actions taken by CATIE have contributed to a sharp turnaround in its financial condition. Its budget is now built on sound financial principles and appropriate measures are in place to assure that the trends initiated over the past two years are continued.

3. Replicability

For this project, replicability will be measured by the extent to which CATIE maintains a staff of watershed management specialists funded by its core budget once the project has ended. It is important to recognize that the project is designed so that junior staff who receive on the job training will gradually replace the senior staff. Thus, in its early years, the project will have a staff larger than CATIE expects to maintain on a permanent basis. Consequently, the future cost to CATIE will be less than the costs associated with this project. Also, if there is a continuing role for the country coordinators, it is expected that the countries will pick up the respective costs, or assistant coordinators funded by the countries will assume full coordinator responsibilities.

As the project staff gains increased experience and expertise, CATIE will begin to charge a fee for the services they provide -- be it to national institutions or donor organizations which request assistance. Initially, no fees will be charged since it will be necessary to demonstrate, first, that the services are essential to the development plans of the region (in a sense this will be part of the awareness building program), second, that the potential savings warrant paying the costs of the services and, third, that CATIE can provide them on a timely and effective basis.

Charging for services is not a new concept for the regional institutions. CATIE is generating income through services provided by its Wildlands program sufficient to maintain a staff of two professionals for the program. INCAE has been increasing the number and scope of the seminars it provides because there is a demand and because they generate a healthy portion of the institution's income. Under the Regional Energy Efficiency project, ICAITI will eventually charge the full cost for its industrial auditing services and, although no direct experience is available yet, preliminary indications are that clients are willing to pay for the services they can receive from the project.

At this time, a specific mechanism which CATIE will install to generate income from watershed management activities has not been developed. It is planned that the mechanism will evolve over the life of the project and will be devised with the assistance of the senior staff who, in large part, will be responsible for generating much of the demand that should result in income generating opportunities for CATIE. The staff will begin to prepare the mechanism in the third year of the project and have it in place by year four.

D. Economic Analysis

Water is a critical natural resource in Central America and a key factor in the development planning for the region. As such, it is an important economic input that must be carefully managed and its use well planned. As discussed elsewhere in this paper, the capacity for planning and managing water resources in Central America is inadequate, and the objective of this project is to address that inadequacy through training and technical assistance intended to build a permanent institutional capacity in the region.

The activities proposed under the project will not directly result in improved watershed management; rather, they will simply provide the means for doing so. Thus, by themselves, project activities will not produce a measurable stream of economic benefits, which makes the conventional benefit-cost or internal rate of return analyses inappropriate.

The nature of the project activities does, however, suggest two alternative measures which are technically appropriate for demonstrating the economic viability of the project.

The first is related to the cost effectiveness of the approach proposed for the project. The question to be examined is whether other, more cost effective alternatives exist to achieving stated objectives. Two potential alternatives are viewed here.

One alternative is to employ consultants to provide advice on watershed management. Initially, this might prove less costly but, in the long run, the continuing requirement for outside assistance would raise the cost considerably. In addition, this approach would neither institutionalize a training capacity in the region nor develop a cadre of professionals capable of providing needed services. Thus, this approach would not be fully responsive to project objectives.

A second alternative would be to develop expertise in the individual universities of Central America rather than in CATIE. This approach, however, would nullify the greatest advantage to centralizing resources in CATIE: economies of scale. No one country in Central America would generate enough demand for watershed management specialists to justify the investment in educational resources necessary for university trained technicians whereas, at CATIE, a centralized source for training would be available to satisfy individual requirements of each country.

The conclusion drawn from these two examples is that the regional approach is the most cost effective alternative available to meet the project's objective.

The second means of measuring economic viability is to assume that the training provided in improved watershed management techniques will be applied in specific cases at the national level. This assumption is considered to be valid because, in the first place, project activities have been carefully designed to promote the use of improved techniques and, secondly, by conducting the majority of the training in the region and focusing it on regional concerns, the technicians will be inclined to stay in the region -- thus making it reasonable to expect that at least one country will decide to try out the improved techniques. Also, a similar assumption is made for all training and institution building projects, and the available evidence indicates that it generally holds true.

The following examples are provided from case studies performed on projects in Central America to illustrate the

potential economic impact of initiating improved watershed management practices.

Of all the benefits that can be derived from watershed management the protection of the region's hydroelectric resources is the most prominent and visible. About $3.6 billion in hydroelectric investments is programmed over the next fifteen years. Without attention to watershed management much of this could be lost.

The economic analysis in Annex I-H contains two case studies of losses that could be incurred if the watershed is neglected. One example is the $624 million Pueblo Viejo hydroelectric project in Guatemala that now will require over $100 million (in 1982 prices) in additional structures to reduce the siltation of the reservoir. Subsequent studies have shown that if watershed management had been considered as an integral part of the original investment, the sedimentation rate of the reservoir could have been reduced by over 50% perhaps avoiding the need for expensive additional structures to control siltation.

The Cachi site in Costa Rica is a second example that points to losses that can result from unanticipated reservoir siltation. In this case, a study revealed that siltation will result in a revenue loss amounting to $133 to $274 million in 1982 dollars. This foregone benefit stream was not compared to the costs of capturing it, but the magnitude of the potential loss is significant nonetheless.

Watershed management activities will generate economic benefits other than extending the life of the region's hydroelectric investments. For example, there can be increases in livestock production and in the output of marketable agricultural output based on maintaining soil fertility and the more wide spread use of irrigation. To cite yet other case study, the activities of the Integrated Watershed Management Project in Honduras included firewood and citrus fruit production in the watershed. In addition to controlling siltation, they were shown to be economically viable in themselves. The benefit cost ratio for the fuelwood component was calculated at 2.12.

The project outputs include five bankable watershed management plans. Given the size of the programmed investments in hydropower and what is known about potential losses in the absence of effective management of the watershed, it can be concluded that if just one of these plans were to focus on an

integrated effort to control siltation around the reservoir of an existing or planned hydroelectric complex in Central America, the economic returns from the effort would by themselves justify the economic costs of this project. In this connection, it must be strongly emphasized that the five plans will be carefully identified and developed in close collaboration with national governments, with a focus on projects which are feasible and promise high economic returns. Therefore, it is very probable that one or more of the bankable plans will actually be implemented.

E. Social Analysis

This project will impact directly on persons trained under the project and indirectly on people living in watersheds where technical assistance will be provided and/or where persons trained will practice their newly acquired skills. Further indirect benefits are expected to accrue to the economies of the region and its people over the longer term as a consequence of better resource planning, management and conservation which will help preserve the value of investments already made in infrastructure and the region's resource base for future development.

1. Training Programs

The field of natural resource management is relatively new to the region and access to positions of influence is still a meritocracy based on technical and management skills. The increasing awareness of donors and the countries of the impact of watershed degradation and its impacts on many aspects of development will create a growing demand for individuals with training in this field over the next decades. Also, awareness activities financed under the project will contribute to creating an effective demand for the individuals trained under the project.

There are three general target groups for training under the project. Future leaders, managers and teachers in watershed management will be given senior level training through the graduate and visiting scholar programs at CATIE and to a lesser extent through graduate programs at U.S. universities. Skills of both senior and mid-level technical personnel already working in the natural resource field will be upgraded through short courses at CATIE and in the countries. Increasing awareness of the implications of watershed and natural resource problems will take place as a result of these two training efforts and specific training programs, e.g., seminars and study tours, aimed at increasing the awareness of policy level officials.

As watershed management is a relatively new discipline for the region, training is clearly the place to start in increasing awareness about natural resource problems and starting to develop effective programs to deal with them. As indicated in previous sections of the paper, watershed management is a development planning tool which helps balance the needs to preserve the environment and the needs of people living in the watersheds and people benefitting from downstream uses of water for drinking, bathing, waste disposal, electric power, irrigation, etc. In general, the situation is not at all that of a zero sum game and all users can benefit from more effective watershed management.

2. Indirect Impacts of Technical Assistance and Training

Adverse social impacts could result to small farmers, ranchers, and the rural population in general, if policy makers in the region were to take a dictatorial and simplistic approach to the problem of trying to solve watershed problems by massive relocations of people living in protection and other areas of watersheds without adequate compensation and relocation services. This is not likely to happen for political and other reasons and would not be an approach recommended in the various training and technical assistance activities to be carried out by the project. On the contrary, the emphasis of the training and technical assistance activities will help national level institutions and technicians to introduce new technologies which will help small farmers and rancher users to conserve their own soils and other natural resources (e.g., trees for fuelwood) while at the same time maintaining or increasing their productivity through modern agricultural and livestock practices e.g., agroforestry, terracing, use of live fences, more suitable crops, etc. The rural population in general will benefit from labor intensive technologies provided by watershed management activities such as plantation reforestation and the agricultural practices described above.

In terms of social soundness, watershed planning is superior to the infrastructural, capital-intensive measures such as the construction of upstream dams taken in recent years. The major reasons for this are that watershed planning takes into consideration the potential social impacts of Watershed Management technologies upon the inhabitants of watershed and tends to be labor rather than capital intensive.

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ACTION: GENERAL DEV
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RURAL DEV
DIRECTOR
CONTROLLER

AIDAC FOR ROCAP

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TAGS:
SUBJECT: ROCAP WATERSHED MANAGEMENT PID
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REF: (A) SAN JOSE 7995 (B) TEGUCIGALPA 10441 (C) GUATEMALA 8852 (D) SAN SALVADOR 9713 (E) PANAMA 10444 (F) GUATEMALA 9626 (G) STATE 336594

1. THE DAEC REVIEWED SUBJECT PID ON NOVEMBER 2,, 1982 AND THE PID WAS APPROVED, SUBJECT TO THE FOLLOWING COMMENTS AND GUIDANCE FOR PREPARATION OF THE PROJECT PAPER. AID/W CONCURS WITH MISSION'S PLAN PER REF. F TO ADDRESS CONCERNS OF BILATERAL MISSIONS EXPRESSED IN REFS A, B, C, D, AND E.

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2. PROJECT STRATEGY. THERE IS CONCERN THAT DECISION-MAKERS IN THE RESPECTIVE COUNTRIES MAY NOT BE RECEPTIVE TO A PROGRAM WHERE THERE ARE HIGH IMMEDIATE COSTS FOR BENEFITS WHICH WILL NOT BE REALIZED UNTIL MUCH FURTHER DOWN STREAM, AFTER MANY OF THE OFFICIALS ARE OUT OF OFFICE. IT IS ALSO QUESTIONABLE THAT EVEN IF THE INSTITUTIONAL CAPABILITY IS ESTABLISHED AT CATIE, THE COUNTRIES WILL USE THE EXPERTISE WHICH IS CREATED. THEREFORE, THE PP SHOULD SET FORTH A STRATEGY BY WHICH THE PROPOSED MIX OF ACTIVITIES WILL IMPROVE THE RECEPTIVITY AS WELL AS THE CAPABILITY OF THE CENTRAL AMERICAN COUNTRIES AND PANAMA FOR TAKING THE NECESSARY ACTIONS TO ADDRESS THE IDENTIFIED PROBLEMS IN REGARD TO WATERSHED MANAGEMENT.

3. INSTITUTIONAL ANALYSIS. THE INSTITUTIONAL ANALYSIS SHOULD CLEARLY DEMONSTRATE THAT CATIE WILL HAVE THE REQUIRED CAPABILITY AND CAPACITY TO PROVIDE THE SERVICES PROPOSED IN THE PP. THE ANALYSIS SHOULD TAKE STOCK OF CATIE'S PRESENT CAPACITY, THE ADDITIONAL REQUIRED CAPACITY TO BE RESPONSIVE TO THE ASSESSED DEMANDS OF THE COUNTRIES TARGETED FOR ASSISTANCE AS WELL AS THE COURSE OF ACTION WHICH WILL BE NEEDED TO ACQUIRE SUCH EXPERTISE.

4. PROJECT ACTIVITIES.

A. POLICY STUDIES. RATHER THAN ALLOCATING A CERTAIN AMOUNT OF PROJECT FUNDING FOR POLICY STUDIES PER SE AND THEN TRYING TO IDENTIFY APPROPRIATE AREAS OF INVESTIGATION, IT WAS DETERMINED THAT SUCH STUDIES COULD BE MORE SATISFACTORILY ADDRESSED IF SUBSUMED UNDER ANOTHER COMPONENT, AS APPROPRIATE. THESE STUDIES SHOULD BE UNDERTAKEN ONLY IN RESPONSE TO REQUESTS FOR ASSISTANCE FROM INDIVIDUAL COUNTRIES AND SHOULD NOT BE INITIATED BY CATIE OR OTHER REGIONAL INSTITUTIONS.

B. PROMOTIONAL ACTIVITIES. THE DAEC QUESTIONED THE EFFECTIVENESS OF PROMOTIONAL ACTIVITIES PROPOSED IN THE PID, SUCH AS THE ANNUAL/NATIONAL WORKSHOPS OR SEMINARS. IT WAS RECOMMENDED THAT PROMOTIONAL ACTIVITIES BE A PRIMARY RESPONSIBILITY OF THE COUNTRY COORDINATORS AND BE FOCUSED ON CATIE'S SERVICES IN TRAINING AND TECHNICAL ASSISTANCE. IN ADDITION, IT WAS SUGGESTED THAT THE MISSION INVESTIGATE THE ADAPTATION OF THE RA,ID APPROACH TO INCREASE AWARENESS OF THE NEED FOR IMPROVED WATERSHED MANAGEMENT IN THE REGION.

C. RESOURCES LABORATORY. THE PID DID NOT ADEQUATELY JUSTIFY THE NEED FOR DOLS 500,000 TOWARDS THE PROPOSED RESOURCES LAB. THE MISSION SHOULD RE-EXAMINE THE REQUIREMENT FOR THE LAB AND WHETHER THERE IS SUFFICIENT CONTINUING NEED FOR SUCH A FACILITY TO JUSTIFY ITS

COST. SPECIFICALLY, THE PURPOSES AND FREQUENCY OF THE USE OF THE RESOURCES LAB SHOULD BE ASSESSED AND DISCUSSED IN THE PP. UNLESS THE MISSION CAN JUSTIFY FINANCING THE LAB IN THE PP, IT APPEARS THAT A BETTER ALTERNATIVE WOULD BE TO CONTRACT OUT THE WORK PROPOSED FOR THE LAB.

D. INSTRUCTIONAL MATERIALS. IN ORDER TO ASSIST IN ASSESSING TECHNICAL ASSISTANCE AND TRAINING REQUIREMENTS, THE NEEDS ASSESSMENT FOR CURRICULUM DEVELOPMENT FOR PLANNING AND MANAGEMENT INSTITUTIONS AND FOR THE DESIGN OF INVESTMENT PROJECTS SHOULD BE PERFORMED DURING THE PROJECT DEVELOPMENT PHASE AND THE RESULTS REFLECTED IN THE PP RATHER THAN AS THE FIRST PHASE OF THE PROJECT ITSELF.

E. TECHNICAL ASSISTANCE. THE JUSTIFICATION, TYPES, AMOUNTS, AND METHOD OF PROVIDING TRAINING AND TECHNICAL ASSISTANCE SHOULD BE DETAILED IN THE PP. IN ADDITION, THE EFFECTIVE DEMAND BY CLIENT COUNTRIES/ENTITIES, FOR

TRAINING AND TECHNICAL ASSISTANCE, AS WELL AS THE OTHER SERVICES PROPOSED, SHOULD BE CLEARLY DEMONSTRATED IN THE PP.

F. TARGET. DURING PP DEVELOPMENT, MISSION SHOULD ANALYZE WHERE POTENTIAL IMPACT MIGHT BE GREATEST WITHIN EACH COUNTRY FOR RESPECTIVE ACTIVITIES (E.G. WHETHER PROMOTIONAL ACTIVITIES SHOULD BE TARGETED AT NATIONAL PLANNING COUNCIL VS. OTHER PUBLIC OFFICIALS; WHETHER NEWSLETTERS SHOULD BE TARGETED TO TECHNICIANS, PUBLIC OFFICIALS OR PRIVATE SECTOR LEADERS).

5. FINANCIAL ANALYSIS.

A. THE FINANCIAL ANALYSIS SHOULD DETERMINE THE AMOUNT OF SERVICES WHICH MUST BE PROVIDED TO GENERATE SUFFICIENT INCOME TO COVER THE RECURRENT COSTS OF SALARY SUPPORT FOR CATIE'S TECHNICAL STAFF.

B. IT WAS SUGGESTED THAT THE MISSION INVESTIGATE FINANCING A SCHOLARSHIP FUND TO PROVIDE TRAINING FOR TECHNICIANS AT CATIE INSTEAD OF PROVIDING SALARY SUPPORT FOR NEW TECHNICAL ASSISTANCE. ONE POSSIBILITY WOULD BE TO ESTABLISH A LOAN FUND AT CATIE FOR SCHOLARSHIPS WHICH WOULD BE MADE AVAILABLE TO TECHNICIANS FROM THE VARIOUS CLIENT COUNTRIES/ENTITIES. THIS WOULD PROVIDE A MECHANISM WHEREBY SERVICES WOULD BE PAID FOR RATHER THAN OFFERING FREE TRAINING. WHILE WE DO NOT NECESSARILY ENCOURAGE THE MISSION TO ADOPT THIS APPROACH, WE THINK IT WORTHY OF CONSIDERATION.

C. CONCERN WAS EXPRESSED THAT THE RATIONALE FOR THE FUNDING LEVELS FOR THE PROPOSED PROJECT ACTIVITIES WAS NOT ADEQUATELY JUSTIFIED. IT IS EXPECTED THAT THE CHANGES IN THE MIX OF PROJECT ACTIVITIES AS RECOMMENDED ABOVE MAY CAUSE A REDUCTION IN THE FUNDING LEVEL AND THAT THE FINANCIAL PLAN WILL PERMIT SUFFICIENT DETAIL TO JUSTIFY THE PROJECT AMOUNT.

WE NOTE THAT PRELIMINARY PROJECT BUDGET DOES NOT INCLUDE FUNDING FOR ANY CATIE QUOTE OVERHEAD UNQUOTE EXPENSES. WE ASSUME PP WILL ALSO AVOID RECOMMENDING ANY SUCH BUDGET SUPPORT.

6. PP SUBMISSION SCHEDULE. WE STRONGLY ENCOURAGE THE MISSION TO ADHERE TO PP DEVELOPMENT SCHEDULE BY SUBMITTING PP IN MID-APRIL IN ORDER TO ALLOW A MAY OBLIGATION. IF THIS TIME FRAME IS NOT POSSIBLE, PLEASE CABLE REVISED SCHEDULE. SHULTZ
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AID 1020-20 (1-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Life of Project:
From FY 83 to FY 88
Total U.S. Funding $6.0 million
Date Prepared: May 16, 1983

Project Title & Number: Regional Tropical Watershed Management

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal targets: (A-4)
To maximize the contribution of watershed resources to the social and economic development of Central America and Panama.	1) Useful lives of hydro-electric projects extended.	SIECA, IDB and other regional statistics.	1) In the long run, hydroelectric power is cheaper than termally (petroleum) produced electricity.
	2) Agricultural production improved by irrigation.	National statistics.	2) Other production factors are amenable to irrigation.
	3) Damage by flooding and drought minimized		
	4) Quantity and quality of potable water supplies im-proved.		

AID 1020-24 (11-72)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose: (B-1)	Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
To improve the institutional capacity in Central America and Panama for managing the region's watershed resources.	1. Permanent capacity to provide appropriate and cost-effective training and technical assistance is established at CATIE. 2. Natural resource and other institutions are utilizing improved plans to manage watersheds. 3. Technicians involved in watershed or natural resources management are better trained. 4. Decision makers are more aware of the benefits of watershed management and correspondingly, watershed management and natural resources receive more support from national governments. 5. Coordination among national institutions responsible for watershed management within countries is improved.	CATIE documents and records National Documents and Plans Two project evaluations	Political situation in CA/P allows national governments to provide human resources and funding for watershed and national resources management and does not prevent implementation of plans and measures in watersheds.

AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	Magnitude of Outputs:		Assumptions for achieving outputs:
A. Training			
1. Expansion of CATIE Graduate Program to include specialization in watershed management.	M.S. specialization designed and installed as part of existing DRNR M.S. program 30 professionals complete M.S. at CATIE 10 professionals complete up to 6 months as visiting scholar at CATIE.	Project quarterly and annual reports, publications, and two evaluations. National records Feedback from other donors.	National technicians available for training on a timely basis. National governments provide minimum support to project: assistant/liaison to project coordinators, office and classroom space, travel and per diem for national technicians.
2. Establishment of Foreign Study Program in Watershed Management.	2 professionals complete M.S. 15 professionals complete post graduate study (up to 1 yr.) at U.S. and Latin American Institutions.		Strong cooperation on part of IDRB, IDB (as indicated in pre-project discussions).
3. Short Courses conducted in countries and at CATIE.	10 short course modules developed, tested and improved. 380 national personnel trained.		
4. Workshops and Seminars conducted in countries and at CATIE.	3 seminar/workshop modules developed, tested, and improved. 200 national technical professional and policy level personnel trained. Computerized simulation presentations.		
5. Study Tours to watershed sites and activities conducted.			

AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	Magnitude of Outputs:		Assumptions for achieving outputs:
B. Advisory Services			
1. Ongoing Long-Term Technical Assistance in Watershed Management provided to countries.	At least one Watershed Management methodology established at each of the 4 levels: National, priority watershed, smaller watershed, operational. 5 bankable watershed management plans, including for international watersheds, developed and funding proposals prepared. Improved integrated watershed management practices evaluated on-the-ground in at least 2 projects. Research programs designed and established in at least 2 projects.	Project quarterly and annual reports, publications, and two evaluations. National records. Feedback from other donors.	
2. Short-term technical assistance jobs in watershed management provided to countries.	60 T.A. assignments completed (average 2 weeks each).		
3. Data Base Information and Assistance provided to countries.	One National Data Base System established and/or improved. Information provided through simple request forms.		

24

AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U. S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	Magnitude of Outputs:		Assumptions for achieving outputs:
4. Instructional Design/Materials and Training Development Assistance provided to countries.	Training/Curriculum Development of national institutions improved. Plans for long-term development including funding proposals prepared for 2 national institutions.	Project quarterly and annual reports, publications, and two evaluations. National records Feedback from other donors.	
C. Support Services			
1. Data Base established	The following are put in place: Computerized Reference Library Map and Photo Collection Geographic Data Base System Watershed Management Descriptive Tables on computer Simulation Programs on computer		
2. Instructional Design and Materials Office established	Short Course and Graduate Course material Seminar and Workshop Materials produced Audio Visual material produced		
3. Project Information Office established	The following produced: Press Releases Regional Newsletter Articles and Letters to professional journals Displays and Demonstrations		

AID 1320-20 (1-79)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY		OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)		Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
AID Contribution				
Personnel Costs	2,175		ROCAP accounting records	Inputs provided on a timely basis.
Training	1,155			
Travel & Per Diem	305			
Equipment	414			
Other Costs	830			
Evaluations	100			
Overhead	732			
	5,711			
Contingency	289			
Total	6,000			
CATIE Contribution				
Personnel	984		CATIE records project quarterly and annual reports.	
Training	190			
Travel & Per Diem	33			
Equipment	198			
Other Costs	55			
Total	1,460			

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance Funds, B.2. applies to projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

   (a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)?

   a. Congressional Notification Process

   b. Yes

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,00, will there be

(a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	a. Yes b. Yes
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	N.A.
4. FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? (See AID Handbook 3 for new guidelines.)	Yes
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N.A.

6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	Project is a regional effort
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	a) No direct impact b) No direct impact c) No direct impact d) No direct impact e) Natural resources management by small farmers, hydroelectric projects and other watershed users will be improved f) No direct impact
8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	U.S. technical assistance will be utilized and U.S. commodities will be purchased from U.S. private enterprise.

9.	FAA Sec. 612(b), 636(h); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The regional institution and the cooperating countries will contribute 16% each to project costs.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes
12.	FY 1982 Appropriation Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A
13.	FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does	Yes, and a principal element of the watershed project includes forestation.

the project or program take into consideration the problem of the destruction of tropical forests?

14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?

N/a

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and

a) Watersheds comprise rural areas, and the technologies integrated under watershed management (for example terracing, grazing management, agroforestry, forest management, etc.) are labor intensive and involve wide participation of watershed inhabitants.

b) The project may result in the provision of technical assistance to cooperatives.

c) The project is designed to build and strengthen in-house capabilities in watershed management.

d) The project will provide training to women.

otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

e) The project will be implemented by a regional institution in close collaboration with participating countries.

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?

Yes

c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?

Project will focus on appropriate low-cost technologies.

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activitiy with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

N.A. Assistance is to regional organization; however, substantial resources will be committed by each participating country to support in-country activities.

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character."	N/A
f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes
g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage	Regional program involves cooperating national technical institutions. Training of national technicians in Tropical Watershed Management Training and technical assistance needs were based on consultants' reports and a comprehensive survey of fifty national institutions.

institutional development; and supports civil education and training in skills required for effective participation in governmental processes esential to self-government.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest. — N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan? — N/A

c. ISDCA of 1981, Sec. 724 (c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)? — N/A

3. Economic Support Fund Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic or political — N/A

	stability? To the extent possible, does it reflect the policy directions of FAA Section 102?	
b.	FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?	N/A
c.	FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives?	N/A
d.	FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes
3. FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	Yes
4. FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be	N/A

financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)	
5. FAA Sec. 604(g). Will construction or engineering services be procured from firms of countries otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one or these areas?	Yes
6. FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates?	Project will comply with section 901(b) requirements.
7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other	

Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? — Yes

9. FY 1982 Appropriation Act Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? — Yes

B. Construction

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services to be used? — N/A

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — N/A

3. FAA Sec. 620(k). If for construction of productive enterprise, will agggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP)?	N/A

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	N/A
2. FAA SEc. 301(d). If fund is established solely by U.S. contributions and administed by an internatioal organization, does Comptroller General have audit rights?	N/A
3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries?	Yes
4. Will arrangements preclude use of financing:	
a. FAA Sec. 104(f); FY 1982 Appropriation Act Sec. 525: (1) To pay for performance of abortions as a method of family	Yes

planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion?

b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? — Yes

c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? — Yes

d. FAA Sec. 662. For CIA activities? — Yes

e. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? — Yes

f. FY 1982 Appropriation Act, Sec. 503. To pay pensions, annuities, retirement pay, or — Yes

adjusted service compensation for military personnel?	
g. FY 1982 Appropriation Act, Sec. 505. To pay U.N. assessments, arrearages or dues?	Yes
h. FY 1982 Appropriation Act, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)?	Yes
i. FY 1982 Appropriation Act, Sec. 510. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields?	Yes
j. FY 1982 Appropriation Act, Sec. 511. Will assistance be provided for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?	Such assistance will not be provided
k. FY 1982 Appropriation Act, Sec. 515. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?	Yes

ANNEX I-D

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

LAC/DR-IEE-83-35

ENVIRONMENTAL THRESHOLD DECISION

Project Location	:	Central America/Panama
Project Title and Number	:	Watershed Management 596-0106
Funding	:	$6,000,000 G
Life of Project	:	Five years
IEE Prepared by	:	Frank Zadroga, ROCAP/Guatemala
Recommended Threshold Decision	:	Negative Determination
Bureau Threshold Decision	:	Concur with Recommendation
Copy to	:	Paul Montavan, ROCAP Director
Copy to	:	Joanne Connolly, LAC/DR
Copy to	:	Frank Zadroga, ROCAP
Copy to	:	IEE File

James S. Hester Date 1 July 1983

James S. Hester
Chief Environmental Officer
Bureau for Latin America
and the Caribbean

ENVIRONMENTAL TRESHOLD DECISION

Project Location:	Central America & Panama
Project Title & Number:	Watershed Management 596-0106
Funding:	$6,000,000 - LOP
Life of Project:	Five years, 1983-1987
IEE Prepared by:	Frank Zadroga, Regional Environmental Management Specialist/ROCAP
Recommended Treshold Decision:	Negative Determination
Bureau Treshold Decision:	
Action:	Copy to Director, ROCAP Copy to James S. Hester, EO, LAC/DR Copy to IEE file

Paul A Montavon
Paul Montavon
Director
ROCAP
Date Nov. 9, 1982

CONCURRENCE:

James S. Hester
Environmental Officer
Bureau for Latin America
and the Caribbean

INITIAL ENVIRONMENTAL EXAMINATION

Project Location:	Central America and Panama
Project Title:	Watershed Management
Project Number:	596-0106
Life of Project:	Five years (FY 83-87)
IEE Prepared by:	Frank Zadroga, Regional Environmental Management Specialist, ROCAP
Date:	Nomvember 5, 1982
Action Recommended:	Negative determination

CONCURRENCE: Paul A. Montavon

Paul Montavon, Director
ROCAP
Date: Nov. 9, 1982

I. Project Description

The project will support a regional effort to develop an increased capability at the national level for the planning and implementation of improved watershed practices with a focus on the protection of hydroelectric catchments.

Project resources will be used to carry out the following: training and curriculum development; data base and information systems development; policy studies; promotion; and advisory services.

CATIE's Department of Renewable Natural Resources will be strengthened in order to provide needed services to the natural resources institutions of the CA/P countries and to assist in the development of scarce human resources with a specialty in watershed management and related fields. It is expected that CATIE will also provide services to donor organizations in the design and analysis of major investment projects which involve watersheds.

The project is essentially an institution building effort, which has as its principal objective the promotion of improved natural resources management and, in the long term, the avoidance of watershed resources degradation.

The AID contribution to this activity over five years, is proposed to be $6.0 million. Project resources will be utilized primarily for technical assistance, training and equipment to support these activities. Procurement of agrochemicals or heavy equipment which might have some effect on the environment is not contemplated.

II. Impact Identification and Evaluation Form

Impact Areas and Sub-Areas	Impact Identification Evaluation 1/
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	L+
c. Land clearing	N
d. Changing soil character	M+
2. Altering natural defenses	M+
3. Foreclosing important uses	H+
4. Jeopardizing man or his works	H+
5. Other factors:	
Forest/watershed vegetative cover	M+

1/ The following symbols were used:

N = No environmental impact

L = Little environmental impact

M = Moderate environmental impact

H = High environmental impact

U = Unknown environmental impact

+ = Beneficial impact

- = Negative impact

B. WATER QUALITY

1.	Physical state of water	M+
2.	Chemical and biological states	L+
3.	Ecological balance	L+
4.	Other factors	
	Water regime	M+

C. ATMOSPHERIC

1.	Air additives	N+
2.	Air pollution	N+
3.	Noise pollution	N+
4.	Other factors	

D. NATURAL RESOURCES

1.	Diversion, altered use of water	N+
2.	Irreversible, inefficient commitments	N+
3.	Other factors	

E. CULTURAL

1.	Altering physical symbols	N
2.	Dilution of cultural traditions	N
3.	Other factors	

F. SOCIOECONOMIC

1.	Changes in economic/employment patterns	L+
2.	Changes in population	N
3.	Changes in cultural patterns	N
4.	Other factors	
	Changes in efficiency of water resource use	M+

G. HEALTH

1. Changing a natural environment	N
2. Eliminating an ecosystem element	N
3. Other factors	
Quality of Water Supply	M+

H. GENERAL

1. International impacts (cooperation in resource management/protection)	M+
2. Controversial impacts	N
3. Larger program impacts	N
4. Other factors	

I. OTHER POSSIBLE IMPACTS (not listed above)

1. Introduction of new plant species	L/U
2. Agricultural chemicals	L/U
3. Other factors	

III. Discussion of Impacts

Because the project involves principally training, regional and national institution building, studies, document and information transfers, and other activities that generally have little or no direct effect on the physical and natural environment, a categorical exclusion is justified per Environmental Procedures 22, CFR, Section 216.C.2.i,ii,iii,vi vi and xiv.

In addition, the indirect effects of project implementation are likely to result in improved environmental management practices and watershed resources protection throughout the CA/P region.

IV. Recommendation

In the light of the nature of this project as well as the programs and actions which could follow it, a negative treshold determination is recommended.

Centro Agronómico Tropical
de Investigación y Enseñanza

Turrialba - Costa Rica - Teléfonos: 56-64-31 - 56-01-69 - Telex: 8005 CATIE C. R.

D-1878
June 25, 1983

Mr. Paul Montavon
Director, ROCAP
C/o. American Embassy
Guatemala, GUATEMALA

Dear Mr. Montavon:

From our close association with ROCAP during the last few years, CATIE has seen a growing mutual concern for the accelerated and uncontrollable deterioration of valuable watersheds in the Central American and Panama region.

Different studies, such as the country environmental profiles, have shown that widespread deforestation in mountain environments followed by poor land use practices are, by far, the main regional environmental problems. The more visible effects of these unplanned changes on land use are irreplaceable soil losses and rapid decline in fertility at the local level; and costly negative impacts downstream on water resources development projects, as well as damage to other important infrastructure investments because of flooding, silting and changes in flow regimes. In this regard, I am pleased to write to you in support of the Tropical Watershed Management Project involving CATIE's Natural Renewable Resources Department.

CATIE's perception for the implications of the lack of watershed management practices and its associated constraints to both rural and national development, began more than twenty years ago with the first of ten research studies linked to an equal number of Master of Science theses on different aspects of watershed management.

About a year ago, and with the aid of AID/ROCAP, CATIE has been able to strengthen the Wildland and Watershed Management Program by adding a full-time hydrologist and watershed management specialist to its staff. A close technical cooperation between CATIE and AID/ROCAP in the conception and development of this Program has increased my conviction that time is running out for a strong push towards promoting integrated regional watershed management, with the training component playing a major role. Appropriate training, both short and long-term, is badly needed in order to support ongoing efforts at the national levels which are facing serious implementation problems due to the lack of qualified manpower resources.

CATIE's long time excellence and experience in training and research in areas such as cattle and range management, multiple cropping systems, agroforestry, silviculture and natural resources planning, all elements to be considered as part of a well conceived integrated watershed management program, constitute a guarantee and a unique opportunity to carry out the intended Project, the only one of its kind in Latin America.

As has happened with other programs, it is expected that the experience, information, equipment and trained personnel to be derived from the proposed Project would allow the continuation at CATIE of a regional training program in watershed management, once the Project ends. This is important because watershed management and soil conservation are long-term undertakings, and the present problems will probably be magnified in the near future due to the population increase and the pressure to expand the agricultural frontiers at the expense of marginal mountain environments.

Other long-term successful regional projects undertaken by CATIE with AID/ROCAP funding have given us the insight and experience to carry out this Project, taking advantage of both the positive and negative aspects learned in their development.

Based on the previous considerations and with the certainty that this Project will constitute a landmark in the regional economic development by promoting a rational and sustained use of the land and water resources, I am hereby requesting AID support for this Project.

In the projected five-year effort at an estimated cost of US$8.86 millions, CATIE's expected contribution in national and international staff, training, travel and equipment, amounts to US$1.46 million, while the support to be provided by the host governments is valued at US$1.4 million. In addition, CATIE will make available to the Project he necessary office space, laboratory and library facilities, supporting transportation, managerial and other related services.

AID, through ROCAP, is requested to contribute the remaining US$6 millions to fund additional national and international staff, travel, training, equipment, vehicles, research funds, and other related supporting activities.

CATIE will work out the necessary agreements with the participating countries of the region in a similar fashion to the Fuelwood and the Small Farms Production Systems Projects.

I am looking forward to a favorable response to this proposal which will allow CATIE and AID/ROCAP participation in a new joint venture to promote rural and national development for Central America and Panama, by laying the foundations to tackle the long overdue need to properly manage the region's valuable but rapidly deteriorating watersheds.

With my very best wishes, I remain

Sincerely yours,

Gilberto Páez
Director, CATIE

I-F. Technical Analysis

Introduction

As a region, Central America is not endowed with a wealth of natural resources. Minerals such as coal and iron ore which form the basis for much of the world's modern industrial sector are practically nonexistent, and only Guatemala has proven reserves of petroleum. The region, does, however, have three major natural resources which are closely linked and which are critical to future growth and development: rich soils, extensive forests and abundant water.

Agriculture is the most important sector in Central America, generating 24% of GDP (14% in Panama). For reasons of mountainous topography or limited soil fertility due to generic or bioclimatic factors, however, much of the region has a reduced land use potential and areas of highly productive agricultural soils are seriously limited. About 6.8 million hectares are under cultivation, with essentially all of te best soils now in use. Although much of the remaining soils do not offer the potential for high output, rapid population growth and the growing demand for food have forced an expansion into areas with more restricted land use capabilities.

Forests are disappearing at an alarming rate due to a complex series of factors such as the increasing demand for fuelwood and growing commercial logging, as well as the demand for additional land to put into agricultural production. For example, between 1952 and 1978 forest cover in Panama declined from 83% of total land area to only 32%, while in Costa Rica tropical forests decreased by 41% between 1950 and 1977. Deforestation has not yet been brought under control by responsible national level institutions. Throughout the region, however, the potential adverse long-term impacts of this type of activity are beginning to be recognized.

The third resource, water, is generally plentiful throughout the region which has an average annual rainfall of 90 inches and extensive systems of watersheds, rivers, tributaries and river basins. Of the three, water has unique role as it provides both a link between the soil and forest resources and also serves as a key input in the development process. Perhaps most striking is its role and potential in the provision of energy through the generation of hydroelectric plants. Approximately 66% of the electrical energy currently produced in the region comes from hydroelectricity. Nonetheless, a large amount of energy must also be produced from petroleum based sources and, in 1981, the oil consumed by thermal power plants accounted for 20% of the

region's $1.0 billion oil import bill. This foreign exchange constraint has been an important contributing factor to the economic crisis which has confronted the region for the past several years.

To reduce their dependence on imported oil, the Central American countries have been developing various alternative sources for providing energy. The greatest emphasis has been in the development of hydro-electricity.

The level of investment in energy projects in 1981 totaled $692.4 million and compared with a total of 435.5 million in 1980, of which $348.2 (80%) was for hydroelectric projects. By 1990, it is estimated that an additional $3.6 billion will be spent on hydroelectric projects.

The generation of energy is only one facet of the role which water has in the growth and development of Central America and Panama. In agriculture, about 5% of the cultivated land is now under irrigation. These lands are devoted mostly to high value commercial crops, are highly productive, and provide a very large share of the region's export earnings. The importance of irrigation to increasing agricultural production is recognized and many new projects are being developed. These projects will also require huge investments with costs averaging on the order of $4,000 per hectare. In addition, many industries use water in the production process, and the urban growth which characterizes the region today must have water for drinking, househould use and sewage disposal.

Over the next twenty years the basic needs for water in the region will increase significantly. To maintain per capita food production in the face of a 3% annual rate of population growth, the demand for water for irrigation (which accounts for almost three-quarters of all human water use) is expected to double by the year 2000. Hydroelectric energy generation has increased more than five-fold in the last twenty years to an installed capacity of 955 MW and is projected to grow to 4,500 MW by the year 2000 (out of a total potential estimated at 31,000 MW). Urban requirements will also grow, particularly if the current pattern of migration from rural areas is maintained. Most notably, the growth of urban centers will put tremendous localized pressure on water supplies.

Using the region's water resources for economic development, specifically hydroelectric power and irrigation, has great potential for the even longer term development of the region. No precise estimates of the region's irrigation potential or potential to the total value of agricultural production are

available, but it is apparent that it is substantial. For example, only 5% of the area's cultivated land is under irrigation compared to 23.6% in Mexico, where the irrigated land produces more than 50% of the value of agricultural production. Yet, whether water can make the economic and social contributions to development noted above in the next few decades is in serious doubt because of the lack of appropriate planning and coordination, and resource degradation such as rapid deforestation and the related problems of watershed.

In an attempt to fulfill the role that watershed management has to play in assuring environmental protection while promoting optimum and sustainable resource use, two sets of capabilities largely determine the region's potential for success: technological capabilities and institutional capabilities.

This annex establishes the technical rationale for this project by assessing: (1) a brief overview of the technological state-of-the-art for managing watershed resources in CA/P; (2) the institutional framework within which the project is to operate; and, related to the two previous points; (3) an analysis of both alternative project designs and the selected "mix" of project components. Detailed institutional analysis of project beneficiaries as it relates to CATIE and national watershed management agencies, is presented in Section B of this Chapter.

1. Overview of Technological Capabilities

Watershed Management is a multi-disciplinary activity that integrates a number of technical fields according to the physical, biological, and socio-economic realities of the particular watershed being treated. Numerous disciplines concerned with resource planning and management are involved, including: land-use planning, resource inventory and land classification; forest management; agroforestry; soil and water conservation; water resources engineering; wildlands and wildlife management and protection; and pollution control.

Technology by itself, clearly will not solve the complex problems of watershed degradation. Technology, however, can provide a viable means for attacking critical parts of the problem.

Considerable literature points to the fact that for many of the essential field techniques experience, knowledge and technology exist. Technology for basic soil conservation, road construction and maintenance, reforestation, forest management, wildfire prevention and control, forest inventories, and many

other fields is sufficiently well known to allow us to do a much better job of resource conservation than presently is occurring.

In other cases, new land use practices are emerging by integrating techniques. For example, several projects in CA/P have demonstrated that soil conservation can be combined with the growing of crops, trees, and other valuable vegetation so that land does not have to be taken out of production to be protected.

The basic principles of afforestation for erosion control are well known, although much remains to be learned about the individual tree species or combinations of vegetation that will be most effective for particular situations. In some cases, afforestation may be combined with terracing or mechanical measures for erosion control.

On the other hand, some technological areas are relatively weak and need a concerted effort to prevent them from being weak links in the technological chain. One example of this includes land capability classification. Land classification methods in the past have been overly detailed, expensive, time consuming, and often based on quite sophisticated technologies. Simple, low-cost rapid techniques - adapted to local conditions - clearly are needed. It should be kept in mind , however, that in this technological area, as in many others, institutional capabilities largely determine what happens in the field. The utility of land capability classifications ultimately will depend on the willingness and ability of planners and managers to apply the techniques; the effectiveness of the regulatory and administrative mechanisms available to insure that the land actually is allocated and used as the classification prescribes; the availability of incentives to insure proper land use; and the acceptance and commitment of the local people.

A second example of technology deficiency is that of native forest management involving intensified silviculture. Closed tropical forests may have, on any given hectare, as many as 100 or more tree species, only a few of which are now considered commercially valuable. The low density of desired species, therefore, has not provided much stimulus for intensified management of the total existing stand. Greater understanding now exists of the complex ecological requirements and interrelatonships of these highly diverse forest types, as well as of the full range of economic values which might be realized through proper management. In addition, an array of new techniques for managing and utilizing mixed forest stands is available. These techniques include improved guidelines for selecting crop trees; better control measures for undesirable

vegetation, insects, and diseases; selective breeding of better quality tree stock; and improved methods for diagnosing soil nutrient deficiencies and prescriptions for forest fertilization; standard, easy-to-use computerized models for predicting growth and yield; and improved tree harvesting techniques that protect the residual mature tree stands and enhance forest regeneration.

The potential uses of many tropical forest trees are fairly well understood as a result of long-term efforts at a number of research institutions throughout the world, including CATIE. The major task is to link advanced silviculture and management techniques with improved utilization in order to realize more of the economic potential of the forest resource. Mechanisms must be developed for making the management techniques more widely known, and for refining them through silvicultural experimentation and demonstration in native mixed tropical forests. Special efforts are needed to increase the economic utilization of more species.

2. Institutional Framework

In juxtaposition with this rather promising array of technological opportunities, a complex set of national, regional and international organizations exist, with growing interests and programs in tropical natural resources management and protection. For CA/P, USAID has in recent years become of the largest contributing agency in the field of resource conservation and forestry. Major projects in Panama, Costa Rica, Honduras and El Salvador have given rise to efforts to strengthen national institutional capabilities. Managerial and technological deficiences, however, continue to be the major constraints to improved resource conservation. Insufficient human resources, both in terms of numbers and training are recognized by the national institutions to be the most serious constraint to short-term improvement. Related to insufficient training, lack of awareness at all levels is another problem that affects the level of commitment of the countries to watershed management. Another principal factor is inadequate investment by the international community, especially relating to resource conservation components of large infrastructure projects (dams, irrigation systems, roads, etc.); this is due to high program costs, lack of awareness, insufficient institutional capacity to carry out the needed actions, etc.

In the light of this complex institutional framework, well coordinated and more efficient resource management protection efforts will require:

1) expansion of the linkages among the national, regional and international institutions through better information exchange and technology transfer;

2) an increase in joint planning and programming; and

3) above all, a strengthening of institutional capabilities within the countries of the region. As will be demonstrated in in the Institutional Analysis, important element in this national institutional strengthening effort are the sharing and further development of scarce human resources and the development of appropriate and cost effective mechanisms for technology transfer. Although watershed management and resource conservation responsibilities reside principally with the governments and institutions of those countries posessing the resources, CATIE, as an experienced and capable regional institution and AID as a principal donor agency, will continue to be looked to for technical assistance, training and financial support.

a. Regional Institutions

Five regional institutions are involved in water resources management in CA/P:

CATIE
SIECA/COMENER
CRRH (Regional Committee for Hydraulic Resources)
ESNACIFOR (Honduran School of Forest Sciences)
ERIS (Regional School of Sanitary Engineering)

b. International Organizations

A host of international organizations also are working with or affecting watershed resources in CA/P. As appropriate, the project will link in with their efforts.

FAO
UNEP
UNESCO
ECLA
World Bank
Inter-American Dev. Bank
OAS
IUCN
WWF
Other foreign countries and the U.S.A.
ICRAF
IUFRO
ISTF
International Society of Tropical Foresters
UNRE

Of most importance in CA/P are the following:

Canada (CIDA and IDCR)
GTZ (FRG)
UK

USA
- AID
- Peace Corps
- USDA - USFS
  - ITF
  - SCS
  - SEA
  - NPS
  - US Dept. of State
  - Smithsonian Institution

- Non-Federal Organizations
  - NAS
  - OTS
  - UNIFOR
  - RBF
  - Nature Conservancy

c. U.S. Institutional Strengths and Contraints

Although the United States possesses a wide variety of public and private institutions that potentially can contribute to an expanded regional program on watersheds, several constraints need to be kept in mind.

The first involves personnel limitations. Despite U.S. involvement in natural resource programs in Africa, Asia, Latin Amrica and elsewhere, this nation has relatively few well-qualified, internationally recognized experts on tropical forest sciences and watershed management. Consequently, U.S. international involvement has been largely as a supplier of funds, equipment and a few experts who work mainly under the leadership of project supervisors from other countries.

U.S. participation in UN forestry programs illustrates this point. Only two U.S. foresters, for example are on the 77-member professional staff of the FAO Forestry Department, in addition to one journalist and one administrator (FAO, 1979a).

The United States has only a few hundred ecologists with field experience in tropical countries, and perhaps a few dozen having extensive experience (Yantko and Golley, 1977). The supply of U.S. ecologists available to deal with practical land management problems in tropical forestry and ecology is small.

The shortage of U.S. forest resource economists trained to interpret long-range economic policies with either direct or indirect effects on deforestation is especially acute.

The United Stateds does have widely recognized and sought-after skills in a number of relevant fields, including watershed management; remote senging; range, forest and wildlife management; and fire control.

A major limiting participation of U.S. forest specialists in international programs is lack of foreign language skills. Only a relatively few U.S. foresters with tropical experience can speak Spanish, and French-speaking foresters with experience in developing countries are even rarer.

The involvement of U.S. foresters abroad also has been limited by a perceived absence of long-term career opportunities. Few U.S. institutions have provisions and incentives that enable their skilled professionals to take part in international work at the peak or "pre-peak" stage of a career without potentially hindering that career. For this reason, persons wanting to work overseas are commonly those early in their careers, or those who are nearing retirement. Such individuals may not have had prior overseas experience, often lack language skills, may be beyond their technical peak, may not be trained to solve tropical problems, or in some cases may have difficulty adjusting to a new culture. Finally, many organizations, already short on staff, are reluctant to let their best personnel go abroad.

Some academic institutions consider faculty research carried out in developing countries to be less valuable than that conducted in developed countries. In some cases where State university funds are involved, research not directly applicable to the State is discouraged, or at least not encouraged. Thus, young faculty may jeopardize their chances for attaining tenure by focusing mainly on tropical research, whether in forestry or some other subject area. One option is for U.S. researchers to affiliate permanently with an institution based in a tropical country, rather than to seek limited duration assignment on detail from their U.S. employers.

The various constraints just enumerated must and will be addressed within the framework of this project.

3. Analysis of Alternative Project Designs and Components

In analyzing the appropriateness of this project with respect to alternative designs and the "internal balance" or mix of its components, it is necessary to refer back to the project goal and purpose:

Goal: To maximize the contribution of water to the social and economic development of Central America.

Purpose: To improve the institutional capacity in Central America and Panama for managing the region's watershed resources.

Given these as our design guidelines, basic alternatives for this project can be analyzed in terms of the WHAT, WHO, HOW, WHERE and WHEN of its implementation.

a. WHAT is to be done?

As has been pointed out previously in several sections of this document, project components are focused on assistance functions (i.e., training, data base, instructional materials, advisory services, etc.) rather than direct field activities. This essential characteristic highlights the key role that this regional project can have in national institution building especially relating to training and technology transfer. Thus, this project will backstop and strengthen bilateral AID projects and other national ongoing actions in the field rather than compete for scarce personnel and other resources.

1) Basic Premise

Watershed Management as a Goal for Getting Integrated Resource Management and Environmental Protection.

Despite this generally discouraging panorama, the CA/P governments as well as many important donor agencies are beginning to appreciate the linkages between resource conservation and economic development, and both developed and the developing CA/P nations perceive a common interest in the protection, conservation and management of tropical watersheds.

Of great importance in this increased awareness phenomena, is the recognition of the benefits derived from the multiple use and integrated resource management approach represented in watershed management. Biologists, ecologists and biogeographers have turned to the watershed as an ideal unit in which to

develop the ecosystems approach. Systems engineers and economists view the watershed as the basis for study and development in terms of river basin planning for economic development. Hydrologists and engineers consider the watershed to be a system within which a balance can be struck between inflow and outflow of water and energy.

In a social science context, the watershed has recently emerged as logical units of understanding and policy making which integrates social, economic and environmental concerns. This emergence is closely connected, in the course of general economic development, with technological change and shifting demands for the main products of a watershed: hydroelectric power, water, timber, livestock, agricultural crops and amenities.

River basin development that combines flood control, generation of electricity, potable water uses and irrigation has been on the increase in many less developed regions of the world but it is ominously absent from the CA/P region. While providing many benefit, large-scale dams, flood control and irrigation projects can also cause highly adverse changes in both fresh water and coastal ecosystems, creating health problems, inundating valuable lands, and displacing populations. While numerous large dams and irrigation projects are planned or under construction in the region, little local capability exists to assess the environmental impact of these development projects and make the necessary adjustments.

2) <u>The need for International Watershed Management and Regional Cooperation in CA/P</u>

Regional and binational cooperation is important to water resources development in Central America. The proper management of international watershed (i.e., watershed hydrographically located in two or more countries) and/or the priority management of watersheds that serve an important regional function/water use, which will be one of the proposed outputs of this project under the component of advisory services, will be encouraged by this project. This action is oriented toward the fulfillmente of two important regional needs:

- The protection of the CA/P regional energy grid (i.e. management of hydroelectric watersheds); as appropriate and opportune in each country, the project staff will encourage the selection of important hydrowatersheds that form or will form a part of the regional grid for planning and management activities.

- The planning and management of international watersheds as a means to promote binational or regional cooperation. Several important international watersheds occur in the region including:

Watersheds	Countries Affected
Changinola/Teribe and Sixaola	Panama & Costa Rica
San Juan	C.Rica & Nicaragua
Coco	Nicaragua & Honduras
Lempa	El Salvador, Guatemala and Honduras

As appropriate in relation to project goals and objectives based upon specific requests from the affected countries, these watersheds will be considered for inclusion into the project actions relating to advisory services and assistance in watershed planning. The Changuinola/Teribe and Sixaola Rivers between Costa Rica and Panama which are also sites for important hydroelectric developments, present an interesting opportunity since CATIE has already been involved in the planning and management of the Friendship Binational Park that protects a good portion of the headwaters of these basins. Also, the Lempa River has been a target for sub-regional cooperation in recent months and interest exists in developing a project oriented around watershed management there. The Project will actively explore these two opportunities and respond as appropriate.

3) Watershed Management vs. No Management

At the most basic level, the CA/P development scenario can be analyzed with and without watershed management. As pointed out in the background and economic feasibility sections of this paper, water resources development and downstream agriculture and urbanization in flood plain areas is not advisable without some method of upland catchment protection. In countries where population pressures are low and mountainous watershed areas can be left in forest and not subject to hillside farming and overgrazing impacts, management will not have to be institutionalized. The native forest cover will protect the watersheds, and water quantity, quality, and regime will be maintained.

In areas where population pressures lead to deforestation and improper land uses in the upland parts of watersheds, water

resources will be degraded in proportion to the degree of "improperness" of the land use after conversion. Since this latter situation is typical of all of the CA/P countries, no watershed management is not a rational option. The following points illustrate from a technical point of view why watershed management is important.

a) Important Downstream Effects of Improper Land Use

The hydrological response or streamflow of a basin is the most obvious index of the adverse effects of land use. The streamflow likewise will reflect good land management practices upstream, including protection or restoration measures.

The adverse effects of upland erosion may be summarized under four principal categories of problems (as seen from "dowstream").

- Siltation (main problems: reservoir silting, degradation of water quality)
- torrential conditions (main problems: farm field losses along steams, village destruction, bedload impacts, river channel cutting)
- higher peak streamflows (problems: flooding, greater tractive forces, meaning more bedload transport)
- less infiltration, hence less baseflow (problem: tendency for streams to dry up earlier or be lower during the dry season).

b) Role of Forests in Reducing Floods and Sediment

For steep topography, a forest cover is often an excellent protection for streamflow, because of the following reasons:

- Infiltration and percolation are typically much higher under a forest cover than if the same catchment is used for agricultural crops (see Table No.1); therefore, more water enters into the ground, and less flows overland;

- Forest soils typically develop a higher detention storage capacity than do soils of farmed fields, largely due to root development; this provides extra storage for flood water protection;

- In general, trees tap and transpire water from deeper in the soil, which also provides storage space for protection against floods;

- During storms forest canopies and their floor litter can trap up to 20 mm. of precipitation by interception (according to field research), again holding back some of the runoff;

- Because of the above processes, forests generally provide a good opportunity for groundwater recharge, which may improve dry season flow conditions downstream. (The actual amount of groundwater recharge, however, also depends on transpiration losses).

In other words, a forest cover maintains storage space which moderates the runoff pattern. This is why protection of existing forests or reforestation of degraded upper catchments can be important in terms of water resource development and flood protection.

It must be remembered that the above listed hydrological benefits are greatest for a mature forest. When a forest plantation is first established, it resembles an agricultural field in terms of its hydrological response, especially if soils have been ploughed or disturbed when removing a previous stand of mature trees. As the forest plantation develops, the benefits which it provides vis-a-vis hydrology will come closer to resembling that of the natural forest.

TABLE 1

Infiltration rates for forest and agricultural land (after Molchanov, 1963). Soil porosities are similar, varying from 48 to 59 per cent.

Land Use	Age	Infiltration rate mm/min
Oak Forest	26	11.4
	60	12.5
	180	7.0
Ash Forest	18	20.7
	36	22.9
	65	16.8
Meadow		6.0
Plowland		1.0
Pasture		0.3
Forest felling area		7.6

To cite an example of the mainly beneficial effects of reforestation, planting 100,000 trees (mainly pines) on severely eroded sites in a TVA area reduced the peak rates of streamflow (m^3/sec) from the catchments by an impressive 90 per cent, with the sediment reduced by 96 per cent. However, the total volume of runoff (i.e. m^3) was reduced by about one half; therefore, the flood and sediment protection benefits were not without a trade-off in terms of the total water yield. In this case, the reduction of peak flows and sediment were more important than the loss in water volume, since the "loss" came largely from the high flood peaks.

Another example of reforestation effects is shown in Figure 1 where the runoff and sedimentation from abandoned farm fields and poor deciduous forests are compared to those areas reforested with pines.

FIGURE 1

Average annual runoff and sediment from three vegetative cover types in northern Mississippi (1958-60 studies by Ursic, 1963)

Vegetative Cover Type	RUNOFF (cm) Loose Soils	Loose & Coastal Plain Soils	Soil Loss (kg.Ovendry per hectare)
Abandoned fields	28	8	398
Depleted hardwoods	13	7	280
Pine plantations (pinus taeda L.)	5	0.5	39

c) Major Direct Cases of Watershed Deterioration in the CA/P Region in their Approximate Order of Importance

- Deforestation of lands only suitable for forest production or protection uses.
- Overgrazing of steep uplands (see Zadroga, 1974)
- Road Construction, in two basic ways:
  (a) Improper design, construction and maintenance
  (b) Secondary effects of colonization of forest lands that should not be cleared.
- Improper agricultural practices, not utilizing adequate soil and water conservation methods.
- Repeated burning of steep lands, especially on the pacific slope.
- Improper logging techniques.

4) Only Structural Measures vs. Watershed Management

In the developed countries, for example the United States, there existed for many years the controversy of how best to develop water resources and protect people from downstream impacts, especially floods. Engineering interest groups, such as the Corps of Engineers, argued that by building structural measures such as dams and levees and other techniques such as flood routing that damage could be controlled. The natural resources oriented institutions, on the other hand, such as the Forestry and Soil Conservation Services, argued that water had to be controlled on the land and that conservation practices had to be utilized to stop floods and control water quality before the damage was done. Numerous years of experience, evaluation and research have generally clarified the controversy and demonstrated that if optimum water resources development and conservation was the objective, a combination of structural and vegetational/conservation practices would probably be needed. Currently water resource issues relate more to what river systems or portions thereby should be developed and what should be preserved for some wild river or wildland uses. Also, conservation efforts are now concentrating more on water quality and pollution problems, overexploitation of groundwater resources, acid rainfall and other similar issues. Watershed management/protection from a forest resources and soil conservation point of view is universally accepted as the necessary thing to do.

In the developing countries, such as those of CA/P, the problem is of another nature. Infrastructural development to provide basic human needs related to water supplies and energy is progressing. Dams, irrigation districts and municipal water systems are being built to meet demands but the protection of the water source is not assured. At the same time, population growth has people colonizing these watersheds, eliminating protective vegetation and disrupting hydrologic responses and water quality, and not realizing that what they are doing has serious consequences for downstream water uses and inhabitants. Thus, the need centers around promoting an integrated development mentality for infrastructural projects as well as increasing awareness of decision makers so as to develop policies, procedures and plans to conserve watershed resources for present and future generations before irreparable damage is done. Structured measures are going forward in all CA/P countries, but generally to meet basic human needs and support economic growth. Watershed management is needed basically to assure the sustained quantity and quality of the resource. In

the developing countries of the region, the task is more of promoting public awareness and getting watershed management institutional capabilities up to what is needed on one side, and creating mechanisms to assure that infrastructural development goes hand in hand with resource conservation.

The specific needs of the countries within the discipline of watershed management were determined by a survey and consultant effort.

b. WHAT Institution is Most Suited to Implement the Project?

1) Regional vs. Bilateral Implementation

As was described in the Project Rationale, this project has been designed to complement the numerous bilateral USAID projects operating or planned in the region. The components were selected largely based upon the felt needs of the national institutions which in most cases are reflections of implementation problems being suffered in ongoing efforts. Thus, this project does not propose components that could conflict by competing for scarce national personnel and resources such as new pilot watershed management projects or in-depth studies and resource inventories. To the degree possible, this project will provide resources for ongoing efforts and provide services that will assist in accomplishing important tasks currently are generally being given low priority: training, data base and information development, and technical assistance (especially for specialized short-term tasks). In addition to fullfilling these immediate needs, the projects goes further to build the national institutions in these same areas so that they be more self-sufficient in the future.

Areas of common concern for USAID projects have been:

- The procurement of appropriate technical assistance in a prompt and cost effective manner;
- Training of project personnel; most projects have suffered from either a lack of training funds or appropriate and sufficient training opportunities;
- Project evaluation and monitoring. Most CA/P projects have had elements in them for technical evaluation, but largely due to little or no research capability and deficiencies in data collection and analysis, evaluations turn out to be less effective and informative.

2) WHICH is the Most Qualified Regional Institution?

Principal regional institutions active in CA/P that are involved with water resources development include CATIE, SIECA's Central American Energy Commission (COMENER), and the Regional Committee for Hidraulic Resources (CRRH). In addition, two regional schools provide training in water resources and related topics. These are the Honduran National Forestry Sciences School (ESNACIFOR) in Siguatepeque and the Regional School of Sanitary and Water Resources Engineering (ERIS), located at the University of San Carlos in Guatemala City.

From the point of view of program orientation and breadth, staff and financial resources, and technical experience, knowledge and technology, CATIE is the only regional institution qualified and capable of carrying out a watershed management project of the scope herewithin contemplated. Each of these other regional entities, however, have their particular areas of expertise and to the degree possible, CATIE will develop linkages with them to provide them with project services and where appropriate draw upon their technical resources.

3) CATIE as a Technical Resource

As a result of CATIE's 30+ years of experience in forest and agricultural sciences, especially as they relate to the socio-economic and institutional realities of the region, certain relatively unique and important areas of technical expertise have been developed. These include agroforestry; fuelwood and community woodlots; and farming systems and wildlands management, all of which constitute important alternatives to deforestation and other causes of watershed degradation.

Agroforestry: For centuries, systems combining trees and agricultural crops have been used on a limited scale by certain farmers and indigenous peoples to take advantage of symbiotic plant relationships. This "local lore", appropriately modified, now is being advanced as a new technology - agroforestry (or agrisilviculture). Agroforestry includes both the planting of trees concurrently with food crops and the rotation of trees and agricultural crops. It involves growing trees not only for wood but also for food, forage, fertilizer, soil and water management, control of wind and water erosion, and other environmental values. Agroforestry can be a means for making continuous productive use of the land without destroying its productivity. In areas formerly under shiting cultivation, it is often compatible with cultural attitudes and traditional practices of local populations. Agroforestry is particularly

attractive because it offers potential for reducing the forest loss rate of two principal sources - shifting cultivation and the opening of forest margins for more intensive food production.

Research, demonstration and information exchange in tropical agroforestry are being expanded or planned by a number of national, regional, and international institutions. CATIE, with funding from United Nations University and linkages with ICRAF (The International Council for Research in Agroforestry) at Nairobi, has been promoting agroforestry technology and working to expand worldwide information sharing. Among its principal interests are the proper selection of food-crop-tree mixes under different rainfall, temperature, and altitude regimes; the sustained management of such systems; their social acceptability; and other constraints on their introduction and use. Most recently, CATIE has been funded by AID to carry out agroforestry training, has been working at a pilot agroforestry project at La Suiza near their Turrialba campus, and has been given a grant to inventory agroforestry practices throughout Latin America.

Community Woodlots for Fuel: The concept of community woodlots has emerged as a response to the expanding demand for fuelwood and its diminishing supply in many parts of the world. Woodlots now are being introduced at an accelerated pace to provide fuel as well as building materials and other forest products. Through CATIE's four years experience in the AID funded Fuelwood project, successful applications to date have been in Panama, Nicaragua, Costa Rica and Honduras. Short-rotation cropping of fast-growing hardwoods such as leucaena or eucalyptus appears to have wide application in many other areas in the region.

Usually the major impediment to successful community woodlots is not a lack of suitable forestry technologies, but rather problems of social organization. Community woodlots must be a "felt need" and have a high degree of local support - especially among poor people. Experience has shown that, without strong popular support, participation, planning, and sharing of benefits, the trees are often destroyed soon after planting. Successful community forestry programs also often require changes in the practices and attitudes of government forestry departments. Near urban areas, woodlots are likely to be commercial enterprises, guarded by their owners or employees.

Improved Small-Scale Agriculture: Forestry is linked closely to farming in most countries. Opportunities exist throughout the tropical world to achieve increased crop production and at the same time to improve environmental

conditions on denuded lands. Improved crop yields on existing cultivated lands would reduce the need to clear additonal forest lands. A large regional effort on agricultural production has been going on for over 20 years with a recently shift toward greater emphasis on the needs of small rural farmers in developing countries. CATIE has been contributing to this "new direction", and their efforts should be encouraged and supported, particularly those related specifically to the agriculture-forest interface, silvo-pastoral relationships and appropriate agroecosystem approaches/technologies.

Management of Wildland Areas: One method of alleviating pressures on the forests is to obtain a yield of resources from the natural forest that exceeds the economic return from forest removal. In many regions aquatic and terrestrial animals, fruits, and nuts from the forest provide major food sources, the value of which has not been totally assessed. Economic benefits accrued from the environmental services forests and watersheds provide also need to be taken into account. The production of quality water is but one of these services. Of great importance in CA/P, preserved or properly managed forests may provide commercial possibilities for recreation and tourism, both national and international.

b.4 CATIE vs. Foreign International Technical Assistance

Although the United States and some other international organizations have resources and expertise that can be drawn upon for an expanded program in watershed management, several constraints must generally be overcome before they can play a meaningful and direct role. In the case of U.S. experts, these constraints involve personnel limitations, cultural and language adaptation/skills, the perceived absence of long-term career opportunities (for U.S. specialists) in international conservation work, and sometimes of greatests impact, cost. The high cost of foreign technical assistance, not only for U.S. independent consultants but also for foreign technical assistance in general, has been objected to on numerous occasions in Central America. Faced with serious economic problems, the CA/P countries are hesistant to pay the high costs of foreign expertise and would prefer to develop their own capabilities or use regional expertise that is generally much more "tuned in" to what is appropriate technology and what is not.

To expand on some of these constraints, in most of the CA/P countries today, there is a pressing need for field guidelines for practical work in soil and water conservation, watershed

management, and land use planning. Too often, however, the soil and water conservation techniques in use are basically those of the temperate zones, slightly modified for use in quite a different ecological zone. It is not surprising that international development projects relying on these modified approaches have sometimes failed.

For example, the watershed management techniques in the western United States grew out of conditions where large tracts of public land are managed separately from private farms, where conservation measures are often mechanized, and where population pressures are minimal by Third World standards. Just the reverse usually occurs in the hilly, agrarian areas of Central America. There forestry is interlinked with small-scale farming, population impacts go high into the hills, land ownership is in a checkered pattern, labor-intensive work is a way of life, and ecological conditions are uniquely tropical. Obviously, the possibility of extrapolating watershed management methodologies are limited, given the two very different sets of conditions.

The opportunity to develop suitable field techniques for soil and water conservation in the tropics needs much more attention. Information transfer from one tropical country to another could be more fully utilized. There are exciting possibilities of evolving a set of field guidelines for a watershed management science that suits the tropics. In some cases, traditional and time-tested conservation methods, such as the ancient terracing of Asia or the runoff harvesting concepts of the Near East predate by far any western notions of conservation. Such traditional conservation knowledge, supplemented with relevant techniques from the West, could be the core of a better and more appropriate technology of conservation in the tropics.

The lack of suitable training for conservation workers, at all levels, in the CA/P countries, as has been pointed out, is one of the greatest problem. Much training in soil and water conservation for professionals is done in Europe or North America, especially the latter. The students return to their home countries armed with a technology that is only marginally relevant to local problems. If they have completed graduate training, it likely had an emphasis on basic research, data analysis, instrumentation and other areas of importance in an industrial country where natural resources work is already at an advanced stage. The important question of extension work probably received minor attention.

Professional training in conservation in the developed countries can be very sectoral. Some students return from abroad with a specialized training in an isolated aspect of conservation, then find themselves responsible for a wide range of extension and management tasks in agriculture, forestry, wildlife, range management, and other areas.

Research in tropical countries in the field of watershed management generally needs to put more emphasis on tackling the practical applied problems. Again, research training relies on education abroad, where the emphasis frequently is on basic research. A more balanced attention to research probably would evolve from more appropriate tropical training, as suggested above.

The various constraints just enumerated, however, must be addressed within the framework of the proposed project. Certain organizations in the United States (i.e. USFS, SCS, Peace Corps, Smithsonian Organization for Tropical Studies, etc.) offer excellent resources for technical assistance.

Among the international organizations, FAO is well known for its competence in the fields of forestry and natural resource conservation. These organizations have widely recognized and appropriate skills to offer, in relevant areas and when the experts to be provided can be carefully screened, it would be short-sighted for the project to not tap these resources. For project staffing, in the highly specialized fields of data base management and instructional materials design, the U.S. has recognized capabilities in those area and it is contemplated that the project draw upon U.S. sources to fill these staffing needs. Not only the individual's expertise but the institutional linkages that could be developed as an additional benefit, make contracting U.S. specialists the best option in these cases.

In searching for specialists to fill the other staff positions, CATIE will take the above mentioned contraints into consideration before selecting people for its program - be they from the U.S., Latin America or some other source. Where possible, CATIE will give priority to Central American or secondly South American expertise.

c. <u>HOW is the Project to be Implemented</u>

There are numerous ways how the project could be implemented and to identify and discuss them is beyond the scope of this analysis. A detailed description of the implementation procedures and schedule is provided in the main body of the

paper and Annex I-H. This analysis will limit itself to a brief description of the key implementation elements and why they were chosen.

The design of this regional watershed management project does not come out of isolation. CATIE has a history of carrying out AID funded projects that have a bearing on this project and their contribution to the design of this one goes back eight years. Also, much experience gained by IICA in previous years has been passed onto CATIE as its research and training center.

As by products of project activities indicated in Table 2 CATIE has not only grown technically, but also perfected its capability relating to (a) organization and operation of projects; (b) methodology and procedures with respect to site selection, conduct of field trials and demonstration techniques; (c) data gathering and processing, and information dissemination; (d) utilization, organization and effectiveness of efforts to involve national/Central American institutions and personnel; and (e) linkages with other AID funded projects and donor development assistance organizations. The most recent and relevant evaluation of a CATIE regional natural resources project was the Fuelwood Project evaluation prepared by VITA (July 1982), 102pp.), which comments on all of the aforementioned aspects of CATIE's project implementation. The small Farms Project was also evaluated.

In brief, the following key elements have been incorporated into this project design that have been proven to be effective in past CATIE regional projects:

- The establishment of a motivated, capable and semi-permanent field staff that provides the organization and national level linkages necessary to maintain country operations at high levels of accomplishment. Thus, the placement of technically qualified, experienced and motivated country coordinators is critical and will allow the outreach effect desired in this project to occur.

- A competent and involved project administrative/management staff at the central headquarters in Turrialba. Experienced and qualified secretaries and capable administrative assistant and technical assistants, and other support staff allow project professional staff to function effectively and draw upon other CATIE personnel (i.e. non DRNR) and in-house institutional services as needs arise.

TABLE 2

Problems No.	Title	Counterpart	Life of Project	Cost (AID) ($000)	Objectives
012	Development of Institutions	CSUCA, FUPAC, IICA	FY 1963-74	$5,072	Develop an integrated university system to produce sufficient professionals to bring about socio-economic progress in Central America.

Activities: Strengthen CSUCA in its planning and coorcination of university education in Central America; assist in developing and improving undergraduate school programs in CA universities; develop specialized regional schools at national universities in the region.

026	Agricultural Planning	SIECA, IICA, CABEI	FY 968-76	869	Improve the institutional capacities to carry out agricultural research, policy studies, and planning.

Activities: Assist SIECA to increase its professional staff for agricultural programming, coordinate its agricultural activities with CABEI and other organizations, undertake studies in agriculture planning and development, implement the action plan for the Basic Grains Protocol, make cost studies for basic grains price supports, identify crops with potential for both export and domestic markets, and expand the market news reporting service for basic grains; assist IICA to assemble, analyze and disseminate agricultural research information, coordinate research efforts in Central America and Panama, serve as a center for collection and dissemination of information on research in modern technology and management, and develop and coordinate a systems approach for agricultural research operations.

048	Agricultural Research and Information System 1/	IICA	FY 1975-79	1,073	Develop and implement an improved, unifor CA-wide system for collection, processing and dissemination of agricultural informa tion.

1/This project is ongoing; cost column shows costs anticipated for life of projects.

Activities: Mobilize action/coordination committees at both national and regional levels for the Central American countries and Panama; inculcate improved procedures and techniques for information management through those committees and subordinate working groups; establish the area frame sample as a basic data collection tool for the region; produce prototype area-specific, agricultural development information packages.

Problems No.	Title	Counterpart	Life of Project	Cost (AID) ($000)	Objectives
063	Soil Fertility 1/	CATIE	FY 1975-78	700	Create a regional system to produce fertilizer alternatives for small farm cropping systems.

1/ This project is completed; cost column shows costs for life of project.

Activities: Provide technical assistance to soil laboratories in the Central American countries; upgrade national and CATIE laboratory facilities; establish CATIE's capacity for soil/fertilizer research coordination; generate data for information package on crop development.

064	Small Farm Cropping 1/	CATIE	FY 1975-79	$1,580	Create a regional capacity to develop cropping system alternatives for small farms.

Activities: Plan and carry out coordinated field trials in all CA countries; provide technical assistance to cropping research in each country and backstop support at Turrialba; publish research results and disseminate through the regional information systems.

1/ This project is ongoing; cost column shows costs anticipated for life of project.

089	Fuelwood and Alternative Energy Sources	CATIE/ICAITI	FY 1980-1985	$7,500	CATIE Fuelwood Component: . Identify critic and potentially critical fuelwood availability areas in the region; . Identify for testing as fuelwood, species of fast-growing trees and provenances that are already known and have been tested in CA/P. . Identify improved management practices for selected fast-growing trees. . Conduct demonstrations of various methods to produce increased supplies of fueldwood on small farms, village or community woodlots and fuelwood plantations. . Strengthen CATIE and national professional and institutional capacities in improved fuelwood production systems.

Activities: Demonstrations, research, training and technical assistance in improved CA/P fuelwood production systems.

- Agroforestry Training (Contract)	CATIE	FY 1981-84	200	. To offer short-term, mid-level training suitable for the countries of CA/P region and the tropics in general in the area of agroforestry. . To develop training materials for both lecture and field activite sin this subject area. . To provide USAIDs with a programmatic framework and institutional capability within CATIE for future training activities in agroforestry.

Activities: Offer four regional short courses in agroforestry; prepare instructional materials for each course and an agroforestry teaching text in Spanish and English; locate and develop, in cooperation with host country institutions, agroforestry demonstration and research sites that will serve ongoing teaching and educational needs of CA/P.

Watershed Management (Grant Agreement)	CATIE	FY 1982-84	150	This Grant Agreement provides funds for the contracting of a watershed management specialist as a staff member of the DRNR. The objectives of this project are to strengthen CATIE and to assist ROCAP in determining policies, plans and actions appropriate for improved watershed management in CA/P.

Activities: Graduate training, research, technical cooperation demonstration, and watershed resources planning.

- Qualified and capable professional staff to provide the leadership and technical guidance needed by the project. These people need to have not only the technical expertise but also language, cross-cultural and inter-personal (i.e. team work) skills to make the project function.

- Adequate funding levels that support project activities in spite of generally bleak economic conditions throughout the region. As can be detected in the budget presentation, funding levels are detailed and tight yet sufficient to allow the project to meet its intended objectives and outputs.

- An integrated data processing and information dissemination capability. This element was detected to be weak in the Fuelwood Project and CATIE is learning from its errors and developing its internal capabilities in these areas. This project should help to further develop CATIE's data base and information resources.

- In linking strongly into national institutions via the country coordinator mechanism, the project is consistent with AID's policy for institutional development. The following essential elements are part of this project design.

  . Transfer of knowledge and technology;
  . Development of institutional learning capacity;
  . Analysis and improvement of institutional and professional linkages/coordination;
  . Improved management systems;
  . Provision of skills and training;
  . Capitalizing upon local capacities and participation.

In considering the opportunities for private sector involvement in conservation activities in the CA/P region, CATIE's Department of Renewable Natural Resources has been a leader in promoting non-governmental organization involvement in conservation. CATIE played a catalytic role in the formation of the Meso American Federation of Non-Governmental Conservation Groups (FEMAC) and has continually strengthened private conservation efforts in Costa Rica, Panama, Honduras and elsewhere, this effort will be continued through this project watershed planning and conservation efforts must occur in close coordination with local communities and CATIE has ample experience throughout the region in this regard.

d. WHEN and WHERE the Project is to be Implemented

As has been pointed out in the Project Rationale, the timing of this project is critical. Watershed Management in the region is long-overdue. As a tool for integrated resource planning and management, it is an essential technological element in environmental quality and resource conservation.

As also has been pointed out in the background information and economic feasibility sections of the paper, an estimated $3.5 billion dollars of investment in hydroelectric infrastructure is programmed for the next 15 years in CA/P and watershed protection is essential to the efficient operation, completion of the projected useful life of the dams, and therefore the economic feasibility of the projects. If other wate resources project for potable water, irrigation, flood control, etc. are taken into account, the investments are much greater. The resource conservation element of these projects cannot be put off. If the watershed that provide water of the required quantity, quality and regeim are made less feasible or may be lost altogether. But another reason for developing strong watershed management capabilities in the CA/P countries is for the timely protection/management against colonization for watersheds that will be used for future water/energy needs.

Given the constraints placed upon project implementation at both the national and CATIE levels, the resources available to the project are limited particularly in terms of staff, staff time and funding. The outreach/country coordinator element of the project, therefore, is designed in such a way that project resources not be over extended and so that the CATIE Central professional staff be given time to establish solid programs and make impact in those countries where the need and potential for success is greatest. Thus, a phased approach has been designed and country coordinators will be established at the end of the first year only in Panama, Costa Rica and Honduras. This technique also recognizes the constraints in national institutional capacity and allows the project to prepare the ground for actions in Guatemala and El Salvador as local conditions and resources permit. The management of these countries in the initial years of the project will be carried out via the country coordinators in adjacent countries and with central CATIE staff support.

I-G Detailed Institutional Analysis of CATIE

A. Organization

1. Summary History

CATIE is situated near the city of Turrialba, 70 kilometers southeast of San Jose, Costa Rica. The valley of Turrialba was selected in 1942 as the site for the headquarters of the Inter-American Institute of Agricultural Sciences (IICA) of the O.A.S. When the General Directorate of IICA was transferred to San Jose in 1960, it maintained at Turrialba those activities initiated in 1942; training and research in agriculture, animal husbandry, and forestry.

To carry out these functions IICA created the Centro de Ensenanza e Investigacion (CEI) at Turrialba. From 1960 to 1969 the training of Latin American personnel in Turrialba was strengthened and that decade saw the steady growth of IICA's Postgraduate Training Program. In 1970 CEI became the Centro Tropical de Ensenanza e Investigacion (CTEI), still a part of IICA and maintained the emphasis on postgraduate training; research continued as a back-stopping activity for training.

2. Creation of CATIE

On January 12, 1973, IICA and the Government of Costa Rica executed an agreement to create the Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE). This agreement was approved by Costa Rica's Legislative Assembly in June, 1973, and Turrialba was designated the headquarters of CATIE.

This non-profit autonomous organization, scientific and educational in nature, was created to promote and carry out research at different levels in the areas of agriculture, forestry, and animal husbandry, with the purpose of responding to the needs of the American tropics, particularly the countries of Central America and the Caribbean.

Upon establishing CATIE, its founders gave it a clear mandate to shift emphasis from teaching to research with a sharp focus toward solving problems of the small farmer. Research was no longer to simply complement the Postgraduate Study Program but was to assume a more active role corresponding to the work carried out by national institutions in order to better respond to the perceived needs of the region's countries.

3. Current Organizational Structure

a. Departmental Structure of CATIE

CATIE's activities cover a wide area of subject matters falling in three basic areas, which are organized administratively as three Departments for the use and management of resources: Animal Production, Crop Production and Renewable Natural Resources. In addition, there is a fourth -- the Department for the Development of Resources for Research and Training.

(1) The Department of Animal Production concentrates its attention on the livestock component of the farm, without losing sight of its close relationship with crops and forestry resources. It is working on the development of dual purpose systems for milk and meat production, and on the utilization of crop residues as feed. Likewise, it is conducting studies on the development of specialized systems of milk production, on the genetic improvement of milk and meat producing species, and on the development of production systems for small farm species (goats, swine, sheep, and poultry), the daily food source and reserve for the rural family.

The experimental station of this Department covers about 325 hectares.

(2) The Department of Crop Production is devoting its attention to work on the agricultural component of the farm, and its relation with livestock and trees. It works on improving traditional cropping systems, such as maize associated with beans, and on the search for alternatives, such as cassava in association with legumes or maize, that make it possible to obtain improved cropping systems. Work is likewise being done on developing mixed systems that contemplate the sequential use of annual and perennial crops. An example is the use of cocoa shaded by plantains and a forest specie, and interplanted with maize or beans. In its work on perennial crops, CATIE is developing high yielding and good quality cocoa hybrids. It is also working on improving coffee production and productivity, an on the control of diseases, such as Coffee Leaf Rust, that threaten this main source of income for many farmers in the region.

The experimental area dedicated to annual crops is about 18 hectares.

(3) The Department of Renewable Natural Resources is concentrating on those typical production systems in which

available, but it is apparent that it is substantial. For example, only 5% of the area's cultivated land is under irrigation compared to 23.6% in Mexico, where the irrigated land produces more than 50% of the value of agricultural production. Yet, whether water can make the economic and social contributions to development noted above in the next few decades is in serious doubt because of the lack of appropriate planning and coordination, and resource degradation such as rapid deforestation and the related problems of watershed.

In an attempt to fulfill the role that watershed management has to play in assuring environmental protection while promoting optimum and sustainable resource use, two sets of capabilities largely determine the region's potential for success: technological capabilities and institutional capabilities.

This annex establishes the technical rationale for this project by assessing: (1) a brief overview of the technological state-of-the-art for managing watershed resources in CA/P; (2) the institutional framework within which the project is to operate; and, related to the two previous points; (3) an analysis of both alternative project designs and the selected "mix" of project components. Detailed institutional analysis of project beneficiaries as it relates to CATIE and national watershed management agencies, is presented in the institutional analysis, Annex I-G

1. Overview of Technological Capabilities

Watershed Management is a multi-disciplinary activity that integrates a number of technical fields according to the physical, biological, and socio-economic realities of the particular watershed being treated. Numerous disciplines concerned with resource planning and management are involved, including: land-use planning, resource inventory and land classification; forest management; agroforestry; soil and water conservation; water resources engineering; wildlands and wildlife management and protection; and pollution control.

Technology by itself, clearly will not solve the complex problems of watershed degradation. Technology, however, can provide a viable means for attacking critical parts of the problem.

Considerable literature points to the fact that for many of the essential field techniques experience, knowledge and technology exist. Technology for basic soil conservation, road construction and maintenance, reforestation, forest management, wildfire prevention and control, forest inventories, and many

Resources Project to preserve species of high genetic value that otherwise would be lost. The project will make materials available to interested countries as alternatives to the farming system components presently in use.

The International Development Research Center (IDRC) of Canada is financing a study of the importance of agricultural bi-products in animal nutrition and is supporting counterpart research personnel to work on farming systems for annual crops in Honduras and Nicaragua. Additionally, the IDRC is underwriting a cattle research project which CATIE developed for IDIAP (Panama). Two more projects being developed for IDRC financing will undertake research on systems for semi-arid zones and research on combined agriculture and forestry systems (agroforestry). The Canadian Government, through the Canadian International Development Agency (CIDA), grants fellowships to graduate students from Latin American countries to CATIE.

CATIE and the InterAmerican Institute of Agricultrual Cooperation (IICA), are collaborating with the French Government in the translation and adaptation of the "Tropical Agriculture Handbook." The Government of the Netherlands has assigned resident scientists to CATIE and is the main sponsor for the Postgraduate Study Program which finances fellowships for professionals from all the countries of the American Continent.

Work in forestry documentation was initiated in 1977 by a technician assigned to CATIE by the Government of Switzerland in connection with its Technical Cooperation Office (CTS). This collaboration includes financing for publications, equipment, and operational expenses in addition to technical assistance.

Preliminary negotiations are underway with the Governments of Japan and Israel to obtain their cooperation in soils and training respectively.

Besides the project support from the governments of the more developed countries, CATIE receives support from several international organizations. With assistance from the World Bank (through the Central Bank of Honduras), CATIE is providing technical assistance to dairy cattle production in San Pedro Sula, Honduras, and a similar project with the Central Bank of Panama is being developed.

For many years the Organization of American States (OAS) has been granting fellowships for the Postgraduate Study Program and has sponsored short courses in specific subjects.

At present the OAS contracts CATIE to do research for the rural development of western Honduras, and a similar activity is under consideration for the Atlantic Zone of Costa Rica.

In support of management and conservation of natural resources in the Central American Isthmus, agencies such as the World Wildlife Fund (WWF), the International Union for the Conservation of Nature (IUCN), the Food and Agriculture Organization of the United Nations; and United Nations' Educational, Scientific and Cultural Organization (UNESCO), have contributed to specific projects.

In joining the international network of institutions associated with the United Nations University (UNU), CATIE became the first member organization to carry out work in the area of natural resources conservation. CATIE and the Institute of Nutrition for Central America and Panama (INCAP) are the two Central American regional centers which are members of the UNU network.

CATIE has received assistance from both the Rockefeller Foundation and the Rockefeller Brothers Fund (RBF). The latter is currently supporting a project on Management and Conservation of Wildlands in the region. Discusssions have been initiated with the Ford Foundation and with the Kellogg Foundation for assistance in socio-economic studies and technology transfer training, respectively. In the private sector, the American Coca Research Institute (ACRI), has supported CATIE activities in the production of hybrid seed necessary for the expansion of cacao plantations in this hemisphere.

Within the region there are several organizations with which CATIE coordinates its programming and project development and implementation. CATIE maintains special coordinating relationships, including mutual support for shared project objectives with ICAITI, INCAP, the Regional Organization for Plant and Animal Sanitation (OIRSA), and the Central American Bank for Economic Integration (CABEI).

Because of its historical association with IICA, CATIE continues to work closely with that organization. The work in research, training, agricultural information generation and transfer as well as technical assistance that both institutions carry out in the Isthmus, requires effective coordination to maximize results.

B. Infrastructure

1. Lands

CATIE's central facility covers 1,069 hectares of the Turrialba, Valley, bordering the western side of the City of Turrialba. Most of this land is relatively flat. The soil lends itself to such crops as coffee, sugar cane, cacao, improved pasture, citrus and other fruit trees, vegetables, and forest trees as well as livestock. There are seven major soil series found at CATIE: Reventazon, Turay, Institute Clay, La Margot, Cervantes, Colorado, and Birrisito (as well as other miscellaneous soils). Of the total land areas some 266 hectares are devoted to crop research programs, 287 to animal research production, and 100 to the natural renewable resources program (including forests). 396 hectares are used for residential areas, buildings, and landscaped areas (the remainder is in commercial production or a reserve).

Some 60 kilometers from Turrialba, between Siquirres and Port Limon on the Atlantic slope of Costa Rica, CATIE has another farm, "La Lola", 102 hectares in size. The climate there is warm and humid with an annual average rainfall of 3500 milimiters. The original vegetation of the area was wet tropical forest. Presently it is dedicated principally to production research development and multiplication of cacao hybrid seed and the commercial production of cacao. Some combined agriculture and forestry studies also are being undertaken at this facility.

2. Buildings and Facilities

CATIE's main facilities include four office buildings, a conference hall and other meeting rooms, classrooms, and teaching laboratories. There are also laboratories and facilities for soils, plant pathology, computer technology, entomology, plant physiology, animal nutrition and physiology, and languages. The Center has numerous greenhouses, a herbarium, two cold chambers for genetic materials, an arboretum, nurseries, and a meteorological station. Recently constructed are a new 24 room dormitory, a warehouse/workshop and a tissue culture laboratory.

Added since the creation of CATIE have been a building for the Cattle and Small Animals Program and one for the Soils Laboratory, a cold chamber for genetic resources, an apartment building to house visiting scientists, an enlarged potable water supply with an internal purification system, and facilities for drying and processing cacao seeds. Most of these facilities have been built with funds derived from the sale of lands.

The Orton Memorial Library was retained by IICA upon the creation of CATIE but is still located in Turrialba, serving the region's countries as well as technicians and students at CATIE. This library, reputedly the finest agricultural library in Latin America, houses over 80,000 volumes, 2300 titles of periodicals, and 110 titles of bibliographical indexes and abstracts. A new library facility was built in 1983.

Other CATIE facilities include three dormitories for bachelor students, 11 apartments for married students, one guesthouse, one apartment building for visiting scientists, 48 residences for technicians, a cafeteria, a recreation center with swimming pool and sports areas, and two school buildings, one for an elementary school and the other for a kindergarten.

3. Equipment

All laboratories are adequately equipped for requisite research and teaching (the modern soil laboratory has a capacity for analyzing 200 samples daily).

CATIE maintains a motor poor of some 60 vehicles (buses, utility vehicles, carryalls, microbuses, sedans, trucks) and a fueling station. It also is equipped with agricultural machinery including tractors, bulldozers, loader, and spray equipment for the commercial farm operation (coffee and sugar cane). The dairy farm has a mechanical milking facility and operates a creamery.

Center equipment also includes Hewlitt-Packard and IBM Computers for processing experimental data. The conference room is equipped with slide film projectors as well as an opaque projector.

C. CATIE's Department of Renewable Natural Resources (DRNR)

1. Organization and Major Activities

The DRNR is currently organized in three interrelated programs: (a) silviculture for the production of wood products; (b) agroforestry systems; and (c) watershed and wildlands management. The Department also is the headquarters for two regional services: Forest Sciences Information and Documentation Service for Tropical America (INFORAT) and the Latin American Forestry Seedbank (BLSF).

In the three major program area diverse study and research is carried out by the professional staff including graduate students under the guidance of professional staff, and results

are disseminated by means of publications, teaching materials and different forms of training such as the post-graduate program, and short-term training from short courses, seminars, workshops and related activities. These various activities are carreid out at the CATIE's main headquarters at Turrialba, Costa Rica, as well in other countries.

Demonstration and technical cooperation activities are also carried out based upon cooperative agreements and requests from countries, principally, although not exclusively, from the Central American Isthmus. In general, the DRNR's activities, be them training, demonstration, or technology transfer, are carried out in close cooperation with national organizations.

The Department and its staff actively participate in different international activities, especially those related to the United Nations organizations, with various international conservation institutions (IUCN, WWF, RARE, etc.) as well as with several bilateral development organizations.

2. Silviculture for Wood Production

The wood production program works on the management of tropical forests with emphasis on the establishment and treatment of plantations of fast-growing species, to satisfy the demands for wood products of the member countries. The program consists of three projects: (1) ROCAP's Fuelwood and Alternative Energy Sources; (2) improvement of fast-growing species of economic value (principally cordia, eucalyptus, and pinus); and (3) investigation on natural secondary forest management.

1981 was the first year with field activities for the Fuelwood Project; in 1980 project activity was dedicated to procurement, recruitment of technicians and professional staff, the establishment of agreements with the national institutions and the designation of counterpart personnel and resources. Since that time CATIE/DRNR has been working in close cooperation with the following national institutions, based upon the formal project agreement established for each case: RENARE (Direccion de Recursos Naturales Renovables) of Panama; DGF (Direccion General Forestal) of Costa Rica; IRENA (Instituto Nicaraguense de Recursos Naturales) of Nicaragua; COHDEFOR (Corporacion Hondurena de desarrollo Forestal) of Honduras; and INAFOR (Instituto Nacional Forestal) of Guatemala. In 1983 CATIE signed a Fuelwood project agreement with CENDREN (Centro de Desarrollo de los Recursos Naturales) of El Salvador, making the DRNR's actions comprehensive for all of CA/P.

3. Agroforestry Systems

This program area is the DRNR's newest. It has the following specific objectives: (1) the identification, classification, description and quantification of traditional agroforestry systems and their components in terms of both their biological and socioeconomic aspects; (2) the validation and improvement of promising traditional systems under controlled conditions; and (3) the design and testing of new promising systems.

4. Watershed and Wildlands Management Program

DRNR's Watershed and Wildlands Management Program (WWM) was added as a program to the department in 1977 with basic funding for personnel and operations provided by the Rockefeller Brothers Fund. Since late 1979 its basic staff of two professional renewable natural resources planning and management specialists, a secretary and some minimal operational funding has been taken over by CATIE's core budget.

The program has been very successful at obtaining small amounts of operational funding for its work in Central America and Panama as well as substantial funding for the individual "on-the-ground" projects in each country and the very frequent regional and national training events which it conducts, from a wide variety of sources: AID/Costa Rica; AID/Panama; FAO; Interamerican Foundation; IUCN; Kellogg Foundation; DDA (Swiss Development Assistance); RARE; UNESCO; U.S. National Park Service; U.S. Fish and Wildlife Service; World Wildlife Fund (WWF).

The Program's forte has been and is, working very successfully with national governmental resource management institutions, particularly interinstitutional-interdisciplinary teams, and in some cases national or local private citizens groups and/or universities, in the following major areas: (1) preparation and implementation of plans and strategies for national systems of wildlands/watersheds*; (2) preparation and implementation of general Management and Development Plans (medium to long-term plans) for a wide variety of individual

*It should be emphasized that wildlands is used by WWM in the broad international definition of the term and includes a wide range management categories such as national forests, multiple use areas, water production reserves, national parks, biosphere reserves, wildlife refuges, hunting preserves, anthropological reserves, etc.

wildland/watershed units of different categories or types as pilot experimental and demonstration areas; (3) preparation of short-term (1-2 years) more detailed operational plans for individual areas and systems, technical support departments and entire institutions; (4) development, testing and improvement of planning methodologies and techniques for (1), (2) and (3) above; (5) development, testing and improving a variety of practical training forms and methods and the training of large numbers of natural resources professionals, technicians and support personnel in regional and national level training events (mobile seminars and courses, short courses, in-service training, M.S. education, etc.), particularly using the pilot projects as training sites; (6) preparation of manuals of planning and training methodologies and sample plans, for wide distribution in the region, based on the pilot projects as case studies; (7) substantially increasing communication and collaboration between the resource management agencies in the region; and (8) increasing several fold the shared use of human resources between the countries (consultants from within the region, in-service training in national institutions, etc.).

All of this had had a very large impact in the region in terms of the wildlands situation in every country which have improved notably in the past decade, and particularly the past 5-6 years, largely due to the catalytic effect in the countries of WWM's work. WWM has, perhaps most importantly of all, greatly improved the quantity and quality of human resources capable of planning and managing wildland/watershed systems, areas and institutions and of strengthening those institutions.

To illustrate this point, we can compare for year 1969 vs. 1981 for the status of wildland areas in CA/P: the total number of areas has gone from 25 to 149; the number of different categories in existance has gone from 6 to 14; the total number of hectares with a legal wildland status has gone from 1.93 to 6.15 million; the percentage of terrestrial this involves has gone from 3.7 to 11.6%; and the number of areas under active management has gome from 8(3%) to 107 (71.8%)

WWM has had two major difficulties. First, both the wildlands and watershed staff is already heavily loaded with work and cannot cover more than 30-50% of the needs and requests from the countries in technical assistance, training, research and education. Secondly, the watershed management portion of WWM has suffered from a lack of strength and external support throughout the life of WWM, although the importance of watershed management as an integrating discipline and the close relationship that watershed has with multiple-use and the other DRNR programs as well as with the other CATIE departments has

been recognized clearly since the start. From 1977 until early 1981 WWM employed a part-time watershed specialist to teach M.S. level courses, guide M.S. student thesis investigations and develop a few regional seminars and training events, but this time was severely limited.

From early 1981 until September 15, 1982 no watershed specialist was at CATIE, until just recently when a Hydrologist - Watershed/Natural Resources Planning and Management Specialist was added with AID/W/ROCAP support. Over the next two years that individual will have the task of strengthening and building up CATIE's watershed management capabilities in M.S. courses, regional short-term training events, guiding M.S. graduate student research, developing a pilot watershed management project near Turrialba and collaborating in technical assistance to fulfill needs in the region. This person will also play a critical role in orienting and assisting in the future development of watershed management as a new program area within CATIE.

Program Activities include: contacts with farmers; the development of surveys and field measurements (quantitative and qualitative); the systematic observation and description of promising species under different environmental and management conditions; the design and carrying out of controlled experiments; and the dissemination of results by means of publications, demonstrations and training/educational programs. Specific research projects include:

- Acosta-Puriscal, Costa Rica: reclamation of eroded and degraded areas in small hill farms;
- Jinotega, Nicaragua: Similar to above;
- Costa Rica Growth of Cordia in different traiditional systems;
- Natural Regeneration of Cordia;
- Coffee production under Erythrina shade with and without Cordia;
- Firewood production from coffee trimmings;
- Propagation of legume species by seed and cuttings;
- Nitrogen Cycling and nutrient balances in different controlled agroforestry associations;
- Tree-perennial crop associations;
- Alder in association with highland pastures.

Professional Staff

Attached is the professional staff list of CATIE personnel and scientists in the Renewable Natural Resources Department (Exhibit I), at Turrialba and elsewhere in the Central American

CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA, CATIE
Natural Renewable Resources Department
Turrialba, Costa Rica, May 1983

STAFF LIST AT TURRIALBA AND ELSEMERE IN THE CENTRAL AMERICAN ISTHMUS

Name	Country	Degree	Specialization	Financing
Gerardo Budowski	Venezuela	Ph.D.	Head of the Department and Agroforestry Program, Land Use, Silviculture, Conservation, Dendrology	Basic Core Budget
Liana Babbar	Costa Rica	B.S.	Agroforestry, Course Coordinator	AID/Agrof.
Jan Bauer	Netherlands	M.S.	Silviculture, Coordinator Firewood Project	Netherlands, Basic Core Budget
John Beer	U.K.	M.S.	Agroforestry	UNU
David Boshier	U.K.	M.Sc.	Forest Genetics	ODA
C.Buford Briscoe	U.S.A.	Ph.D.	Head of Silviculture Program	Basic Core Budget
José J. Campos 1/	Costa Rica	Ing.For.	Silviculture, Firewood Production	ROCAP/Fuelwood
Ben Chang	Taiwan	Ing.For.	Forest Seeds	ROCAP/Fuelwood
Juan Delgadillo 2/	Nicaragua	Ing.Agr.	Silviculture, Firewood Production	ROCAP/Fuelwood
Nancy Glover	U.S.A.	B.S.	Agroforestry	GTZ
Jochen Heuveldop	Federal Rep. Germany	Dr.rer. nat.	Agroforestry	GTZ
Humberto Jiménez	Colombia	M.S.	Forest Information, Dendrology, Coordinator INFORAT	DDA
Valentín Jiménez	Costa Rica	Ing.Tec.For.	Silviculture, Firewood Production	ROCAP/Fuelwood
Agustín López	Costa Rica	Lic.	Administrative Assistant	UNU
Craig MacFarland	U.S.A.	M.S.	Head of Wildland and Watershed Management Program, Natural Areas, Fauna	Basic Core Budget
Johny Montilla 3/	Bolivia	M.S.	Silviculture, Firewood Production	ROCAP/Fuelwood
Daniel Murmilled	Suiza	Dr.Forest.	Silviculture	DDA
Héctor Martínez 4/	Colombia	M.S.	Silviculture, Firewood Production	ROCAP/Fuelwood
Francisco Mesén	Costa Rica	Ing.Agr.	Tree Improvement	DDA
Claudia Monge	Costa Rica	B.S.	Forest Information	DDA
Elia Mora	Costa Rica	Ing.Tec.For.	Agroforestry	IDRC
Róger Morales	Costa Rica	Naturalist	Wildlife, National Parks	Basic Core Budget
Augusto Otárola 2/	Perú	M.S.	Silviculture, Firewood Production	ROCAP/Fuelwood

1/ Assigned to the Forest Service, San José, Costa Rica

2/ Assigned to Nicaragua, in Managua with IRENA

3/ Assigned to Honduras, in Tegucigalpa with COHDEFOR

4/ Assigned to Guatemala, in Guatemala City with INAFOR

Name	Country	Degree	Specialization	Financing
John R. Palmer	U.K.	M.A.	Manager, CATIE Forest Estate, Forestry Data Bank	ODA
Walter Picado1/	Costa Rica	Ing.Tec.For.	Silviculture, Firewood Production	ROCAP/Fuelwood
Norman Price	Canada	M.E.S.	Agroforestry	CIDA
Carlos Quesada	Costa Rica	Ph.D.	Watershed Management	ROCAP/Watershed
Carlos Reiche	Guatemala	M.S.	Economics of Natural Resources	ROCAP/Fuelwood
Emel Rodríguez 1/	Costa Rica	Ing.Tec.For.	Silviculture, Firewood Production	ROCAP/Fuelwood
Arturo Romero 5/	Colombia	Ing.For.	Silviculture, Firewood Production	ROCAP/Fuelwood
Ricardo O. Russo	Argentina	M.S.	Agroforestry, N-Fixation	IDRC
Rodolfo Salazar	Costa Rica	D.Phil.	Silviculture, Firewood Production, Forest Genetics	ROCAP/Fuelwood
Eduardo Somarriba	Nicaragua	M.S.	Agroforestry	UNU
Luis Ugalde	Costa Rica	M.S.	Silviculture, Firewood Production	ROCAP/Fuelwood

5/ Assigned to Panamá, in Panamá city, with RENARE

CIDA = Canadian International Development Agency, Ottawa, Canada

DDA = Swiss Program of Cooperation for Development, Berne

GTZ = German Agency for Technical Cooperation, Frankfurt

IDRC = International Development Research Center, Ottawa, Canada

ODA = Overseas Development Administrationof the United Kingdom, London

ROCAP = Regional Office for Central America and Panama, of US-AID (Agency for International Development) headquarters in Guatemala

UNU = The United Nations University, Tokyo

Isthmus. Support staff for these professionals not listed include 11 secretaries, 6 field assistants and 15 field laborers. Annex II.C presents the job descriptions of the senior and junior professionals staff to be employed under the proposed project.

D. An Overview of CATIE's Experience with AID Projects

Table 2 of the Technical Analysis Annex gives details of some of the more important AID funded projects carried out at CATIE that have some relation to the proposed project. CATIE's knowledge of AID is substantial and as a result of these numerous project experiences CATIE and its DRNR are capable of carrying out the personnel, administrative, financial, and other types of management functions necessary to implement a project of the magnitude of this proposed Regional Watershed Management project.

E. CATIE's Linkages to National Institutions

Under this Project, CATIE will have the opportunity to build upon existing links to several national and regional institutions. All of the region's Ministries of Agriculture or their agencies have memoranda of understanding with CATIE and cooperative project agreements exist with RENARE (Panama) (DGF Costa Rica), IRENA (Nicaragua), INAFOR (Guatemala), COHDEFOR (Honduras), and CENDREN (El Salvador) for the implementation of the Regional Fuelwood Project. With the exception of Honduras, where the linking agency will likely be the Ministry of Natural Resources, CATIE will be able to build upon good operative working relationships. In addition, the governments of Panama, Costa Rica, Nicaragua, Guatemala and Honduras are now members of CATIE and contribute to its core budget support. Other institutions, both public and private have indicated an interest in working with CATIE in the area of watershed management and will be encouraged to take part in the project effort. The following discussion identifies some of the key institutions in each country that are already working with or are expected to work with CATIE.

1. Panama

The Ministry of Agriculture (MIDA) and its Direccion de Recursos Naturales Renovables (RENARE) will be the primary public sector collaborators in that country. RENARE and MIDA are extremely interested in natural resource conservation and specifically watershed management, and have been actively implementing for almost four years the AID Watershed Management Project, which will be used as a source of data and expertise

To cite an example of the mainly beneficial effects of reforestation, planting 100,000 trees (mainly pines) on severely eroded sites in a TVA area reduced the peak rates of streamflow (m^3/sec) from the catchments by an impressive 90 per cent, with the sediment reduced by 96 per cent. However, the total volume of runoff (i.e. m^3) was reduced by about one half; therefore, the flood and sediment protection benefits were not without a trade-off in terms of the total water yield. In this case, the reduction of peak flows and sediment were more important than the loss in water volume, since the "loss" came largely from the high flood peaks.

Another example of reforestation effects is shown in Figure 1 where the runoff and sedimentation from abandoned farm fields and poor deciduous forests are compared to those areas reforested with pines.

FIGURE 1

Average annual runoff and sediment from three vegetative cover types in northern Mississippi (1958-60 studies by Ursic, 1963)

Vegetative Cover Type	RUNOFF (cm) Loose Soils	Loose & Coastal Plain Soils	Soil Loss (kg.Ovendry per hectare)
Abandoned fields	28	8	398
Depleted hardwoods	13	7	280
Pine plantations (pinus taeda L.)	5	0.5	39

c) Major Direct Cases of Watershed Deterioration in the CA/P Region in their Approximate Order of Importance

- Deforestation of lands only suitable for forest production or protection uses.
- Overgrazing of steep uplands (see Zadroga, 1974)
- Road Construction, in two basic ways:
  (a) Improper design, construction and maintenance
  (b) Secondary effects of colonization of forest lands that should not be cleared.
- Improper agricultural practices, not utilizing adequate soil and water conservation methods.
- Repeated burning of steep lands, especially on the pacific slope.
- Improper logging techniques.

National Extension University (UNEN), the Universidad Nacional (UNA), the Universidad de Costa Rica, the Instituto Tecnologico de Costa Rica for collaboration in project actions dealing with training and support services.

In the private sector, ASCONA and other natural resource conservation associations and the Tropical Science Center have expertise and resources that could be tapped by the project.

3. Nicaragua

The appropriate Nicaraguan government institutions have indicated to CATIE by means of the regional watershed management survey their interest in participating in this project.

The principal institutions active in water resources management in Nicaragua that would potentially be involved are the Institute of Renewable Natural Resources and Environment (IRENA), the National Energy Institute (INE), the Ministry of Planning (MIPLAN), the Ministry of Agricultural Development and Agrarian Reform (MIDINRA) and the Central American University.

In compliance with the Brooke-Alexander amendment, however, Nicaragua will not be incorporated into the project in its initial phases. Thus, activities relating to training, advisory services of direct benefits to Nicaragua or physically located in Nicaragua should development assistance relations become normal in the future, Nicaragua will be considered for inclusion into project implementation toward the end of the project. This could involve placement of a country coordinator and putting into operation training, support services and advisory services.

Funds for the participation of Nicaragua have not been provided for in the budget. Additional funds would be requested from AID/W once compliance with the Booke-Alexander prohibition is met and conditions in Nicaragua permit. This request for funding would include a more specific project design as well as a detailed implementation plan specifically for the Nicaraguan element.

4. Honduras

Various institutions in Honduras have extremely valuable experiences and data for the Project. They can be expectedto collaborate in one or more phases of the program. The Coporacion Hondurena de Desarrollo Forestal (COHDEFOR) has worked with CATIE previously as has the Ministerio de Recursos Naturales (MRN). MRN has been principal implementing agency for the AID Natural Resources Management Project with a major part

of the activity in watershed management, and therefore will be CATIE's principal counterpart in Honduras.

COHDEFOR, the National Planning Council (CONSUPLANE), and the National Electrical and Energy Agency (ENEE) are expected to cooperate in the Project. Also, the Escuela Nacional de Ciencias Forestales (ESNACIFOR) which trains most of the country's practical foresters has some watershed science in its curriculum and is interested in opening up a new curriculum in watershed management. It will be invited to collaborate in training courses and to cooperate in the data/information services component. It is also envisioned that ESNACIFOR be a recipient for advisory services for curriculum development.

Data from the FAO/MRN/COHDEFOR watershed projects at Lake Yojoa and Choloma as well as the CATIE/OAS project at Santa Rosa de Copan will be valuable to the Project. The large ENEE hydroelectric project "El Cajon" will be seriously considered as a recipient for this project's services.

5. El Salvador

No other country in the CAP region has as serious a watershed situation as does El Salvador. The Ministerio de Agricultura's (MAG) Centro para el Desarrollo de Recursos Naturales Renovables, (CENDREN), the Centro Nacional de Tecnologia Agropecuaria (CENTA), the Instituto Salvadoreno de Tierras Agricolas (ISTA), and the Electricity Institute are all extremely concerned with deforestation and protection of watersheds, especially the Rio Lempa. Research work on leucaena for fuel and animal feed is being carried out by the public sector as is the planting of a number of tree species for forest products, fuel, erosion control, agroforestry, and windbreaks. El Salvador has numerous watershed management, and especially soil conservation field experiences to build upon. Past FAO projects in Metapan and Chalatenango (Rio Lempa) have important concepts and data to contribute. MAG's Office for Small Farm Irrigation (OPOR) is another agency interested in the project as it relates to water conservation on upland small farms.

Collaboration by the MAG and its dependencies in forestry watershed management, and soil conservation will be the linchpin for Project activities in El Salvador. CENDREN will be CATIE's primary counterpart institution in El Salvador. Due to the extreme seriousness of the watershed problem in El Salvador there is little doubt that project actions, especially oriented toward training and advisory services in watershed management/planning, small farm irrigation and soil and water

conservation practices (including fuelwood and agroforestry) will be appropriate and accepted.

Due to a limited institutional and human resource capacity, however, the project does not contemplate placing a coordinator in country until the fourth year, after training and support/advisory services would have had an opportunity to strengthen CENREN's capacity in watershed management. Project activities during the initial three years will be coordinated from Honduras or Guatemala as well as CATIE's central offices.

6. Guatemala

In Guatemala, there is a growing interest in watershed management and planning. All Guatemalan institutions surveyed and especially the Instituto Nacional Forestal (INAFOR), the Instituto Nacional de Electrificacion (INDE), the National Planning Council (SGCNPE) and the Universidad de San Carlos (both ERIS and CECOM) demonstrated a willingness to cooperate with the project. Also, Guatemala was the only country where unanimous agreement among the institutions was shown in the selection of a pilot/model watershed project: the Rio Chixoy as defined by the Chixoy Hydroelectric Project.

INAFOR will be CATIE's primary counterpart agency. It is expected that Guatemala will be phased in with a country coordinator during the third year of project.

I.H Economic Analysis

A. Introduction

To develop and maintain the long term economic potential of the Central American countries, it is necessary to manage their watersheds. Central America has an abundant supply of water, but excessively high erosion rates are common due to the nature of the environment and poor watershed management practices. Soils are rich but thin, with much of the agriculture being practiced on very steep slopes.

The focus of this project is training and institution building that will contribute to the human capital base of the countries of this region. It will not result immediately in a stream of measurable economic benefits, although some time in the future increased skills and awareness will result in investments in watershed management that, in one way or another, will add to the economic welfare of the population of Central America.

Since this project will not yield outputs that are economically quantifiable, the traditional tools of microeconomic analysis are not appropriate. We cannot show in a quantitative fashion that the eventual stream of economic benefits will outweigh the costs of this project. We will only be able to show through illustrative material that better trained and more aware technical staffs will be better able to preserve the region's water resources and that this capability will, in time, yield economic benefits far outweighing the cost of this project.

The cost effectiveness of this project is an issue that must also be addressed. One alternative would be to employ consultants to do whatever analysis on watershed problems that may be required. Initially, the use of consultants might prove to be less costly, but they would not leave expertise behind them and, consequently, would not contribute to the project's objective of eventual self-sufficiency. Another option that must be considered is the development of expertise in the individual universities of Central America rather than in CATIE. This approach, however, would nulify the greatest advantage to centralizing resources in CATIE: economies of scale. No one country in Central America would generate enough demand for watershed management specialists to justify the investment in educational resources necessary for university trained technicians. Investment in one institution that would serve the needs of all the CA/P countries, would be far more efficient. We believe, therefore, that the approach embodied in this project is the least cost method of achieving the project objective.

In light of the above discussion, the following outline will be followed in this economic analysis:

- Benefits of watershed management
- Demand for hydroelectric energy
- Case Studies

B. Benefits of Watershed Management

Watershed management is primarily oriented to controlling accelerated erosion, i.e, that occurring in excess of natural rates and can be viewed as one alternative for protecting the natural endowment. Some examples of alternatives to watershed management are increased maintenance costs such as the addition of fertilizers to sustain productivity, dredging of sediments from water conveyance structures, and the actual replacement of an investment by substitutes or duplicate structures. Since all alternatives, including watershed management, involve costs, the costs and benefits on a site specific basis must be weighed carefully to select the appropriate option or combination of options.

Most alternatives have the potential to produce multiple benefits. This is particularly true with the watershed option as illustrated in the case studies that are discussed later. In general the benefits include higher quality water, reduced cost for maintaining structures, maintenance of soil productivity, and more constant and reliable streamflows.

Watershed management is accomplished by manipulation of the natural and man-made environment. It involves adjusting the way in which man carries out his efforts to produce or extract products from the environment so that the productivity of the resource base is indefinitely sustained. Costs in the form of production constraints or carrying out additional protective measures are required to practice watershed management. Since the objective is to maximize economic returns, watershed management should be incorporated as a component of all major activities that impact on the watershed.

All alternative activities have a cost and in the case of watershed management, three can be identified. Firs, developing expertise has costs embodied in training and salaries. Second, developing infrastructure has costs such as information gathering and maintenance of institutions. Significant benefits can be obtained from investing these first two cost components. Damage can often be prevented by applying watershed expertise to development plans and activities. The third cost arises when on

site measures are taken. These measures include such activities as the planting of trees and the construction of terraces. The Panama watershed case study in the last section illustrates a project involving all three cost components.

Watershed management affects the quantity, quality and distribution of runoff. These direct effects impact on the total physical and biological environment. Of particular concern is the impact of water on economic activities. How the environment responds produces economic effects; variation in crop yields, hydroelectric energy, and potable water are some examples.

Watershed management stimulates economic growth in several ways: a country's balance of payments can be improved by extending the life of domestic hydroelectric facilities thereby reducing the need to import energy; agricultural exports can be increased by sustaining and improving soil productivity; per capita incomes can be increased by improved productivity; and disaster relief costs can be reduced by naturally regulating and modulating the flow of runoff water.

Watershed management has not been a major component of development projects in Central America. Garcia (1) estimates that in 1982 between .5 and 3.5 million dollars were spent on watershed management in all of Central America. As a contrast, there are a number of current development projects in Southeast Asia with larger amounts of funding. The following is an unquantified but real list of benefits accuring from those projects:

- Increases in agricultural livestock production and farm income;
- Increased outputs of saleable products such as fuelwood, fodder, and timber resulting from reforestation and restoration of existing forests.
- Increases in the life span of irrigation and power works (mainly outside the watershed) due to reduction in silting.
- Savings of loss and damage to human life and property and increased productivity of downstream agriculture by reducing peak flows mainly outside the treated watersheds.
- Rehabilitation and conservation of the natural resources (mainly soil and other sources) of the treated watersheds.

It is logical to assume that these benefits would also accrue to the countries of Central America.

C. Demand for Hydroelectric Energy

Of all the potential benefits listed above, watershed management can be justified in Central America solely on the basis of need to protect hydroelectric facilities. There are other equal or perhaps more important justifications such as the need to protect soil productivity or flood/drought mitigation, but they are more difficult to quantify. For this reason hydropower is the focus in this section.

Electrical energy is key to economic growth. Central America currently meets from 60% to 70% of its energy needs by hydroelectric generation. The balance is obtained through fossil fuels. Table 1 shows the percent by country.

TABLE 1

Percentage of Total Energy Generation from Hydroelectric Sources (1981)

Country	Percentage (%)
Costa Rica	99
El Salvador	53
Guatemala	24
Honduras	89
Nicaragua	48
Panama	51

Source: (1)

Approximately 946 megawatts (MW) of power are currently under construction at a cost of approximately $1.23 billion. The supply of electrical energy may be maintained or increased in three ways:

- Building additional hydroelectric structures;
- Building additional fossil fuel plants; or
- Increasing emphasis on watershed protection and management.

While the last item may not at first be thought of as a means of supplying electrical energy, it can be shown to have a direct relationship. Watershed management can reduce the rate of siltation of reservoirs and thus extend the useful life of existing and planned hydroelectric facilities. This indirectly adds to the supply of electrical power.

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Watershed management has two added advantages in meeting the demand for electrical energy. First, hydroelectric sites are non-renewable resources, once they are developed and the reservoir silts up their usefulness is drastically reduced and they will be lost to the system. Watershed management can reduce the rate of depletion of this important regional resource. This problem is particularly acute in El Salvador where a very limited number of potential dam sites are available. The second advantage of watershed management is that it can reduce the importance of imported fuels thus relieving the pressure on the balance of payments.

The United Nations recently completed a report (2) projecting the demands for electrical energy in Central America and Panama into the 90's. These projections shown in Table 2 indicate that demand will achieve a rate of growth slightly above that in the 70's or about 1.1% per year for 1982 through 1990 and will accelerate to 1.7% per year for the period 1990 through 1995. These projected growth rates indicate a demand for electrical energy consistent with an economic growth rate that will increase per capita incomes annually into the 90's(10).

A list of projects--prepared or under construction-- to meet the projected demand for energy is contained in Table 3. The majority-- 71% of the projects or 96% of the planned capacity-- is hydroelectric. Each megawatt of hydroelectric capacity cost on the average 1.3 million dollars to plan and construct. Based on this figure, the total cost to construct all projects in Table 3 is $5 to $6 billion. If only half are completed the program will still be the most significant single investment in Central America over the next 15 years.

Without attention to watershed management million of dollars of this investment could be lost. A lack of regional data precludes a good estimate of how much could be saved. However, erosion rates in other parts of the world (5), suggest that a reduction in siltation by 1/3 could be achieved by watershed management practices.

D. Case Studies

Four case examples have been developed in order to illustrate some of the economic gains that could be achieved with watershed management practices. The first, Cachi, illustrates the probable economic loss of hydroelectric energy due to deforestation of a watershed. The second, Pueblo Viejo, is also a hydroelectric case illustrating structural investment loss due in part to poor

TABLE 2

Central American Isthmus: Projections of the Electric Energy Market

Energy Demand

	Central American Isthmus	Guatem.	El Sal.	Hond.	Nic.	C.R.	Panama
1985							
Requirement	1415	201	238	180	176	348	272
Percentage	100.0	14.2	16.8	12.7	12.4	24.6	19.2
1990							
Requirement	2163	346	400	282	294	470	371
Percentage	100.0	16.0	18.5	13.0	13.6	21.7	17.2
1995							
Requirement	3242	554	656	442	458	621	511
Percentage	100.0	17.1	20.2	13.6	14.1	19.2	15.8
Med. Rate of Grow							
1982-1990	9.0	9.3	12.5	10.3	11.6	6.5	6.7
1990-1995	8.4	9.9	10.4	9.4	9.3	5.7	6.6

Source: (2)

TABLE 3

ISTMO CENTROAMERICANO: RETRASO EN LA ENTRADA EN OPERACION DE NUEVAS CENTRALES ELECTRICAS

	TIPO	POTENCIA INSTALADA (MW)	COSTO 10^6 US$	FECHA INICIO OPERACION ERICA	FECHA INICIO OPERACION ACTUAL	RETRASO
Guatemala						
Pueblo Viejo Quixal	Hidro	300	630	1982	1983	1
Zunil	Geo	15		1985	1986	1
Santa Maria II	Hidro	68		1982	1987	5
Chulac	Hidro	440	658	1986	1989	3
Xalala	Hidro	360	393	1986	1992	6
El Salvador						
San Lorenzo	Hidro	180		1982	1983	1
Berlin	Geo	55		1984	1986	2
5 de Noviembre	Hidro	120		1987	1986	a/
El Tigre c/	Hidro	540	388		1992	
Honduras						
Puerto Cortez	Diesel	30		1979	1984	4
El Nispero	Hidro	23		1981	1982	
El Cajon	Hidro	292	478	1983	1986	b/
Cayamel e/	Hidro	525	534		1991	
Nicaragua						
Momotombo II	Geo	35		1983	1986	3
Nojolka c/	Hidro	159		1987	1989	2
Costa Rica						
Corobici	Hidro	174		1982	1982	-
Ventanas-Garita	Hidro	90		1985	1986	1
Geotermica	Geo	55		1986	1987	1
Boruca	Hidro	600	812	1991	1993	2
Panama						
La Fortuna d/	Hidro	321		1983	1985	2
Changuinola	Hidro	240	495	1988	1991	3

a/ Adelanto de un ano.
b/ La fecha oficial de inicio de operacion es finales de 1985.
c/ Proyecto sustitutivo del proyecto hidroelectrico Britos.
d/ Se refiere a la primera etapa del proyecto.
e/ 1982 dollars from 3

watershed management. The third case, an integrated watershed project, is an example of the potential for increased crop returns from agroforestry (a form of watershed management). The last contains an explanation of the economic analysis for a multi-purpose watershed project in the Canal Watershed. None of these cases are expost analyses, but they are based on sound information and projections. All examples are Central American projects and are intended to serve as a sample of potential economic benefits from practicing watershed management in the region.

1. Cachi-Costa Rica

The Cachi case example illustrates the power loss resulting from reservoir siltation and changes in stream flow regime. The case is based on a series of simulation runs that accelerate erosion and alter stream flow characteristics (5), i.e, peak and base flow. The changes are assumed to result from removal of the natural forest cover and are based on available literature.

The economic loss was calculated using the simulated energy loss over a 50 year period, times $100/megawatt hours (see Table 4).

The $100/MWH is an estimate of the cost to produce energy using a fossil fuel plant (6). This is a likely substitute and reflects world fuel pricing. The revenue losses were discounted to a present net worth using 7% and 15% discount rates. The economic loss was $274 million and $133 million respectively. The calculated revenue loss is concluded to be the amount of increased benefits that could be captured if the watershed is managed in the future to prevent the occurance of accelerated erosion above current levels. This case study illustrates the problem facing many of the hydroelectric facilities in Central America with small reservoirs and accelerated erosion and should serve to illustrate the potential for significant revenue losses due to poor watershed practices.

2. Pueblo Viejo (Guatemala)

The Pueblo Viejo (PV) hydroelectric project has recently been completed at a cost of $624 million. It is considered necessary to construct additional structures in order to reduce siltation of the PV reservoir thus protecting the investment and the site.(6) Six upstream structural measures (2 sand traps and 4 hydroelectric reservoir projects) were evaluated (see Tables 5 and 6). The Palzajel project was considered to be the most cost effective of those evaluated with a B/C ratio of 1.23.

TABLE 4
Hydroelectric Revenue Loss

TIME (YEARS)	ENERGY LOSS 1/ (MW-H)	Present Net Worth ($m US) at 7.5%	at 15%
1	64,824	6,482	6,482
2	106,872	9,248	8,081
3	128,722	10,366	8,342
.	.	.	.
.	.	.	.
.	.	.	.
50	252,288	678	23
Present value		274,070	132,920

1/ Times 100 = dollar loss.

TABLE 5

PRELIMINARY ECONOMIC EVALUATION

MEASURE TAKEN	EXTENDED LIFE OF PUEBLO VIEJO (YRS)	VALUE OF PROJECTED ENERGY FROM MEASURE (10^6 Q)	VALUE OF PROJECTED ENERGY FROM EXTENDED LIFE IN PUEBLO VIEJO (10^6 Q)	TOTAL VALUE OF BENEFITS (10^6 Q)	COST OF MEASURE (10^6 Q)	BENEFIT COST RATIO
Serchil	16	94.5	43.9	138.4	206.2	0.67
Palzajel	35	52.9	55.8	108.7	88.2	1.23
Sandtrap Palzajel Site	16	--	43.9	43.9	41.0	1.07
Jocotales	11	61.1	36.0	97.1	150.4	0.65
Los Tapezcos	24	52.3	51.3	103.6	138.3	0.75
Sandtrap Chitomax II Site	2	--	9.3	9.3	27.0	0.34

Note: All costs and benefits are 1980 present valves calculated with an interest rate of 9%.

Source: (6)

TABLE 6

FINAL ECONOMIC EVALUATION

	10^6/Q COST 1980 PRESENT VALUE	AVERAGE FIRM	10^6 GWH ANNUAL ENERGY NON-FIRM	10^6 Q 1980 PRESENT VALUE FIRM	NON-FIRM	TOTAL	BENEFIT/COST RATIO
SCHEME A							
Pueblo Viejo	526	1,020	567	1,360	315	1,675	
Palzajel	88.2	62	57	41	16	57	
TOTAL	614.2	1,082	624	1,401	331	1,732	2.82
SCHEME B							
Pueblo Viejo	526	1,020	567	1,360	315	1,675	
Equivalent Steam Plant	112.4 (2)	62	57	41	16	57	
Pueblo Viejo Replacement	31.4	(1)	(1)	(1)	(1)	(1)	
TOTAL	669.8	1,082	624	1,401	331	1,732	2.59
SCHEME C							
Pueblo Viejo (0-60 YRS)	526	1,009	574	1,338	317	1,644	
Pueblo Viejo (60-100 YRS)	--	740	820	5	3	8	
Equivalent Steam Plant	112.4	62	57	41	16	57	
TOTAL	638.4	1,071 (3)	631 (3)	1,384	336	1,720	2.69
		802 (4)	877 (4)				

(1) Included in Pueblo Viejo.
(2) Cost for steam plant includes fuel costs at 1980 values
(3) 0-60 YRS
($) 60-100 YRS.

Source: (6)

TABLE 7

Station and/or Sub-Basin	Drainage Area (Km2)	Total Sediment Load		Total Sediment Yield
		Tons Year	Decreased Tons/Year	Tons/Yr/Km2
1. Chisiguan	2,245	2,465.782	2,383,953	1,098.34
2. Chisiguan too Las Torres	3,405	2,099.057		616.46
3. Las Torres	5,650	4,564.839	3,482,995	807.94
	11,300	9,129,678	4,866,952	

Source: (6) Modified

The Palzajel project will be completed in 1990 at a 1982 cost of $104.7 million. This cost less 62.9 million for on-site revenues, leaves $41.8 million directed to sediment reduction. In other words, a maximum of $41.8 million would be directed to alternative sediment control.

The analysis did not consider a watershed management alternative (ie., improved vegetative cover and a possible small on-site structure). The report did state that sediment studies of the various subwatersheds suggest that reforestation and land management should be given every encouragement. Based on sedimentation studies extensive soil erosion due to poor land management is occurring in the watershed. Proper land management in the three sub-basins might reduce the sedimentation rate by 53%. Thus, this estimate suggests that 53% of the $41.8 million planned expenditures for siltation control might be effectively spent on watershed management.

Another consideration worth noting is that the sediment rates are based on actual sediment samples reflecting current and past land management practices. If we assume that erosion will accelerate due to increased activity in the watershed then planned structures will be even less effective than currently predicted and watershed management opportunities become more attractive.

3. Integrated Watershed Case Study (Honduras)

An economic analysis of the Integrated Watershed Management Project in Honduras was developed (4). The project area consisted of two small watersheds managed for fuelwood plantations and for agricultural crop production. The purpose of this project was to increase the income of small local farmers, and to permit production on a sustained basis. The fuelwood portion involves reforestation using superior species and results in decreased degradation of the soil and increased production of wood fiber. The crop production in terraces using intermediate agriculture technology results in increased crop production, reduced soil erosion and eliminates the need for shifting agriculture. Benefits not included in the analysis are: 1) a reduced need to clear additional areas of natural forest; 2) a reduced need to expand into less productive and less stable lands; 3) a reduction of stream sedimentation and its impact on downstream water improvements; and 4) more stable rural employment.

Two benefit cost ratios were developed for the project. They differentiated between fuelwood and agricultural cropping. Benefits are those derived from the value of the fuelwood and

crops. Costs are project costs and the farmers labor. Three variations of crops grown on terraces were tried. All had a positive B/C ratio. The combination of orange trees with the first two years of a 20-year rotation in corn and yuca, was found to be the most profitable cropping alternative. Table 8 summarizes the results for fuelwood and crops presenting them in 1982 present net values terms. The B/C for fuelwood is 2.12 and 1.65 for the most effective cropping alternatives. According to the project report, the most important conclusion is that the fuelwood and cropping activities are highly profitable.

4. Canal Watershed Case Study (Panama)

The Panama Watershed problem is typical of what is happening in much of Central America.

> "The rapid growth of Panama's rural population during the last thirty years has resulted in an expansion of traditional agriculture ("slash and burn") an extensive cattle grazing in watershed areas which were previously covered with forest".(11)

These activities may maximize short-term economic gains but are resulting in depreciation of natural resources and are damaging important investments. Both are essential to long-term economic growth in Central America.

The economic analysis of this project is useful to review for it covers a broad range of impact (as opposed to the other "case studies" which are much narrower in their focus) and the economic analysis uses a commonly accepted approach.

The project has 6 major activities: (1) institution building; (2) educational activities; (3) creation of forest reserves; (4) reforestation; (5) soil conservation; and (6) pasture improvement.

Tables 9 and 10 summarize the results of the total analysis. It should be noted that the net benefit of the project varies considerable from $1.9 million to $.15 million depending on the discount rate chosen.

TABLE 8

Integrated Watershed Project Cost and Benefits

TREATMENT	COST/ HECTAR (16%)	BENEFIT HECTAR (16%)	B/C RATIO
Fuelwood	L. 285	L. 604	
	$. 222	$. 471	2.12
Oranges with 2 years of corn and cassava on hill side ditches	L. 1.915/1 $ 1.495/2	L. 3,160 $. 2,466	1.65

1/ 1979 Lempiras
2/ 1982 US$

TABLE 9

Projected Selected Plan
National Economic Development Account

Components	Measure of Effects	
BENEFICIAL EFFECTS:	(Average Annual)[1] B/000	
A. Value of Increased Outputs of goods and services	6.625%	12%
1. Agricultural & Forestry Production	2267.7	1095.4
2. Sediment Reduction Benefits		
a) Transportation	294.6	186.7
b) Generation	285.7	103.5
3. Utilization of Underemployed labor resources	198.6	306.8
Total Beneficial Effects	3046.6	1692.4
ADVERSE EFFECTS:		
A. Value of Resources required for a plan	6.625%	12%
1. Institutional Development	166	294
2. Educational Activities	22	35
3. Reserve & Park Management		
a) Project Installation	157 (0)[2]	242 (91.1)[2]
b) OM & R	140	140
4. Reforestation Activities		
a) Project Installation	334	515
b) OM & R	100	100
5. Soil Conservation	93	142
6. Pasture Improvement		
a) Project Installation	81	126
b) OM & R	40	40
TOTAL ADVERSE EFFECTS:		
Net Beneficial Effects (B/000)	1913.6	58.4
Net Beneficial Effects (with EQ costs removed) B/000)	1913.6	149.5

1/ 60 years @ 6.625 and 12 per cent interest
2/ These are costs that would be allocated to the EQ objective.

TABLE 10

SUMMARY COMPARISON BETWEEN ALTERNATIVE PLANS

ACCOUNT	Selected Plan		NED Plan		EQ Plan		Extended Selected Plan	
NED (B/000's)	6.625%	12%	6.625%	12%	6.625%	12%	6,625%	12%
Beneficial Effect	3,046.6	1,692.4	57,071.8	30,372.8	-484.4	-602.2	28,325.0	15,840.6
Adverse Effects	1,133.0	1,634.0	8,563.0	12,213.0	1,238.0	1,684.0	24,322.0	10,473.6
Net Beneficial Effects	1,913.6	58.4	48,508.8	18,159.8	-1,722.4	-2,286.2	4,003.0	5,367.0
Net Beneficial - EQ1/	1,913.6	149.5	--	--	--	--	4,003.0	5,369.0
REGIONAL DEVELOPMENT.								
A. Income: (B/000)								
Beneficial Effects	3,046.6	1,692.4	57,071.8	30,372.8	-484.4	-602.2	--	--
Adverse Effects	967.5	1,182.1	8,360.1	11,747.6	1,079.0	1,360.0	--	--
Net Beneficial	2,079.1	510.3	48,711.1	18,625.2	-1,563.4	-1,962.2	--	--
B. Employment (Average number of jobs year).								
Project Installation.	2,300	2,300	28,437	28,437	460	460	4,025	4,025

1/ Excluding costs allocated exclusively to EQ objectives.

REFERENCES

1. Garcia, Luis "Analysis of Watershed Management", AID/ROCAP Contract 596-0000-G00-2030-00, Project No. 596-000.6, 1982.

2. Naciones Unidas, "Consejo Economico y Social, Istmo Centroamericano: Flujos de Energia Electrica en un Sistema Regional Integrado", 1982.

3. Supplemental Information to UN Report (2) above.

4. Dongelmans, Leo, "Analisis Financiero de Reforestacion para Lena y Cultivos en Terrazas", Documento de trabajo No.6, Tegucigalpa, Honduras, PP.86, Septiembre 1980.

5. Quesada Mateo, Carlos A."Effect of Reservoir Sedimentation and Streamflow Modification on Firm Power Generation", Doctorial thesis, Colorado State University, Fort Collins, Colorado, 1979.

6. Lahmeyre International, "Pueblo Viejo Sedimentation Study", Volume 1&2, Instituto Nacional de Electrificacion, Republica de Guatemala, Centro America, 30 pages.

7. World Bank, "Report and Recommendations...for the Upper Magdalena Pilot Watershed Management Project". Report No. P-3106-CO, World Bank, Washington, D.C., Pages 24. November, 1981.

8. Spears J.S. and Rowe R.D.H., "Preliminary Guidelines for Designing Watershed Rehabilitation Projects for Bang Financing", prepared for the World Bank's Second Agriculture Sector Symposiumk, 24 pages.

9. Gregsen, H.M. and Arnoldo H.C., "Economic Analysis of Forestry Projects", FAO, UN, Rome, 1979. Pages 193.

10. Dourojeanne M.J. "Renewable Natural Resources of Latin America and the Caribbean", World Wildlife Final, Washington, D.C. Pages 495.

11. AID, "Panama Project Paper Watershed Management", Department of State, Agency for International Development, Washington, D.C., 1979

12. Water Resources Council, "Procedures for Evaluation of National Economic Development Benefits and cost in Water Resources Planning", Part IV, Federal Register, Vol. 44, No. 242. Dec. 1979.

13. FAO Handbook on Monitoring and Evaluation. Social Forestry Projects. 1983

CATIE
REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT

IMPLEMENTATION PLAN

ANNEX

ACTIVITY	1983	1984	1985	1986	1987	1988
A. Administrative and Coordination Activities						
1. Sign initial Project Agreement CATIE/ROCAP						
2. Prepare key implementation letters CATIE/ROCAP						
3. Prepare first year's detailed operational/work plan and budget and ROCAP approval						
4. Obtain first disbursement						
5. Search for, selection and recruitment of Project Manager, Land Use Specialist, Chief Tech. Asst. (M.S.), Admin. Asst. and bilingual Executive Secretary						
6. Remodeling and construction of key offices and other facilities for basic core staff						
7. Procurement of equipment for basic core staff (office, 2 vehicles)						
8. Project Manager and other basic core staff on board (initially)						
9. Rapid review/modification first year operational plan & budget						
10. Preparation and finalization of additional necessary letters of implementation						
11. Search for, select and recruit all additional project staff						
12. Procurement of remaining equipment and vehicles						

ACTIVITY	1983	1984	1985	1986	1987	1988
13. Visit all primary and secondary watershed management related institutions in countries to explain project design and obtain initial committments						
14. Formation of National and Regional Advisory Committees						
15. Amendment of existing or establishment new memoranda or agreements with principle counterpart agency in each country						
16. Establishment of agreements with additional participating national agencies						
17. All additional staff on board (initially in each case)						
18. National Advisory Committee Meetings						
19. Annual Regional Committee Meetings						
20. Annual work/operational plans and budgets completed and sent to ROCAP for approval						
21. Annual obligation of funds						
22. Progress reports including executive summary						
23. Annual technical reports (early March)						
24. Periodic financial/admin. reports						
25. Annual financial/admin. reports (March)						
26. Final technical report						

ACTIVITY	1983	1984	1985	1986	1987	1988
27. Final financial/admin. report						
28. Project monitoring (ROCAP)						
29. External evaluations						
30. Short-term consultants						
31. Coordination of techn. activities and administration/ finance						
32. Preparation of project continuation strategy						
33. ROCAP-AID administrative tech. assistance						
B. Component #1: Training (5 countries)						
1. Technical Short Courses						
a. Design and prepare modules and materials						
b. Identify and select participants						
c. Arrange all logistics						
d. Conduct and evaluate short courses						
1) Data Base Management (2 courses)						
2) Data Base Enumeration (10 courses)						
3) Curriculum Development (1 course)						
4) Developing Instructional Materials Systems (1 course)						
5) Large-Scale Integrated Watershed Planning (2 courses)						

ACTIVITY	1983	1984	1985	1986	1987	1988
6) Watershed Planning, Programming and Implementation (2 courses)						
7) Fundamentals of Applied Soil and Water Conservation (2 courses)						
8) Project Proposal Preparation (1 course)						
9) Analysis and Evaluation of Projects (1 course)						
10) Others (2-3 courses)						
2. Study Tours						
a. Identify specific needs in countries						
b. Identify possible sites, projects, themes						
c. Design study programs						
d. Identify and select candidates (final)						
e. Execute tours						
3. Workshops, Seminars and Technical Meetings						
a. Design and prepare modules and materials						
b. Identify and select participants						
c. Arrange all logistics						
d. Conduct and evaluate events						
1) Natural Resources Policy Seminar for Decision Makers (1 event)						

ACTIVITY	1983	1984	1985	1986	1987	1988
2) Senior Professionals Basic Management Seminar (3 events)						
3) Central America Watershed Mgmt. Workshop (1 event)						
4) Tropical Watershed Workshop (1 event)						
4. CATIE Graduate Program						
a. Design and prepare courses, modules and materials						
b. Identify, recruit and select candidates						
c. Conduct program/students studying						
5. Non-Degree Graduate Studies						
a. Graduate Studies						
1) Identify needs and candidates						
2) Identify potential programs and design studies						
3) Conduct programs/students studying						
b. Visiting Scholar Program						
1) Identify needs and candidates						
2) Design studies/programs						
3) Conduct program/students studying						
6. Self-study Prototype Curriculam						
a. Design and prepare module and materials						
b. Test and evaluate in one country						

ACTIVITY	1983	1984	1985	1986	1987	1988
7. Redesign and improvement of training event modules based on testing						
8. Publish and distribute final modules in the region, rest of Latin America and to international/bilateral agencies						
9. Follow-up evaluation of training programs and trainees						
10. Establish, instrument and equip outdoor laboratory/ experimental watershed (Río Tuis)						
C. Advisory Services						
1. Prototype and Ongoing Watershed Management Activities						
a. Identify and select key common regional problem-oriented type activities with country agencies and AID's						
1) In Panamá, Costa Rica and Honduras						
2) In Guatemala						
3) In El Salvador						
b. Design planning methodologies, methods and/or techniques for each case						
c. Apply methodologies, methods and/or techniques: prepare plans, programs, research designs, etc.						
d. Provide continuing advisory services during implementation of plans, programs, research designs, etc.						
e. Evaluate implementation						

ACTIVITY	1983	1984	1985	1986	1987	1988
f. Prepare case studies and publications (manuals, plans, etc.) and distribute in region						
g. Integrate activities/sites into training programs						
h. Prepare proposals for further national and international funding						
2. Short-term Technical Assistance						
a. Identify needs and select activities						
b. Provide assistance						
c. Evaluate assistance provided						
3. Data Base Information and Assistance						
a. Develop data base recording forms for countries						
b. Train Country Coordinators in data collection, processing, retrieval (i.e. system operation and use)						
c. Train country personnel in data base system and management and data recording, numeration, etc.						
d. Advise countries on data collection needs and coordinate collection efforts.						
e. Advise countries on establishment and/or improvement of in-country data base management systems						
f. Develop information retrieval request forms						
g. Provide information to countries based on requests						

ACTIVITY	1983	1984	1985	1986	1987	1988
4. Instructional Design/Materials and Training Development Assistance						
a. Study and evaluate regional needs for an undergraduate university program and a technical school program in watershed management			----			
b. Evaluate universities and technical schools and select one of each for such programs.			----			
c. With those schools design in detail complete programs and prepare proposals for national and international funding				------		
d. Design prototype curricula and materials package for those schools					----	
e. Provide specific assistance in design, organization and curricula development to national institutions (management and educational ones) for establishment and execution of training programs and events.				- - - -	- - - -	- - - -
f. Provide training modules, publications, information and similar materials to the countries			- - -	- - - -	- - - -	- - - -
D. Support Services						
1. Data Base						
a. Documentation Center						
1) Design and develop Computerized Reference			—	- - - -	- - - -	- - - -
2) Develop annotated bibliographies and reference lists based on library and distribute to countries' institutions on regular basis			- -	- - - -	- - - -	- - - -

ACTIVITY	1983	1984	1985	1986	1987	1988
b. Geographic Data Base/Documents, Maps, Photo, etc. Collection						
1) Design, adapt and initially establish data base system						
2) Compile and review existing information and enter into system						
3) Identify gaps and determine information to be obtained						
4) Develop data base recording forms for countries and instructional manual for data base information collection						
5) Train Country Coordinators in data base system management, operation and use						
6) Train country personnel in data base system and management and data numeration						
7) Collect new information and add to system						
8) Evaluate system and procedures and make adjustments/improvements						
9) Integrate documents, maps, photos, etc., into Documentation Center						
c. Watershed Management Descriptive Tables, Indices, etc.						
1) Design system and basic table/index types						
2) Obtain information						

ACTIVITY	1983	1984	1985	1986	1987	1988
3) Prepare tables and indices						
d. Training Evaluation/Follow-up Data Base						
1) Design data base						
2) Operate data base						
e. Simulation Programs for Watershed Planning and Management						
1) Design programs						
2) Prepare programs and integrate into training curricula						
3) Test in short courses, workshops and seminars and graduate courses						
4) Improve and publish/distribute programs						
f. Identify other data base needs and develop systems as appropriate						
2. Instructional Design and Materials						
a. Detailed diagnostic study of training needs in the region including analyses of tasks, learner performance, audience (target groups) and communication systems						
b. Preparation of performance goals and objectives with project core staff						
c. Identification and acquisition of existing instructional materials						

ACTIVITY	1983	1984	1985	1986	1987	1988
d. Design, adaptation, modification of instructional activities and materials						
e. Production of instructional materials						
f. Use and testing of instructional designs and materials (short-term training events and graduate program principally)						
g. Design and conducting of evaluation methods for instructional effectiveness of designs, materials and delivery systems						
h. Revision of designs, materials and systems						
i. Maintenance, repair and replacement of materials and media as necessary.						
3. Project Information Office						
a. Prepare and publish project general brochure						
b. Prepare project basic audiovisual program and displays						
c. Prepare other general brochures or audiovisual materials or modify existing ones as necessary						
d. Prepare, publish and distribute project technical newsletter/bulletin						
e. Prepare articles for general conservation magazines, newsletters, bulletins, etc.						
f. Prepare press releases and manage press relations.						

ACTIVITY	1983	1984	1985	1986	1987	1988
g. Organize and conduct tours of project for government, educational and other leaders						
h. Organize, manage and handle visitors, both groups and individuals						
i. Provide advice and instruction to country coordinators on planning, logistics and management of awareness activities and publications, public relations and visitors.						
j. Assist in preparation and reproduction of progress and final reports.						
k. Organize and manage a complete photographic and other materials documentation unit for the project.						

II-A Regional Tropical Watershed Management (USDA/OICD Summary Report)

Introduction

Water is a key natural resource in planning for economic growth in Central America and Panama (CAP). To ensure that long term benefits from this resource are received watersheds must be well managed. The PID recommending development of a major new watershed management project pointed out " --There was no question as to the importance of watershed management to environmental problems or to the development of the energy, agriculture and health sectors in the region".

The basis for the proposed project are the goal and purpose statements that were developed jointly between the interested parties.

Goal

To enhance the social and economic welfare of the people of Central America and Panama through sound, integrated watershed management to maintain or upgrade water quality, quantity, and distribution as part of rational land use.

Purpose

To strengthen and establish national and regional institutional capacities and awareness in Central America and Panama for managing the region's watershed resources.

The team in developing its proposed program for watershed management studied many documents and talked to many individuals from organizations directly and indirectly linked to the program. At CATIE, these individuals not only were members of the professional staff, but many students from mostly Latin American countries. The views expressed by these individuals, where appropriate, were incorporated into the team's proposed project. The team also incorporated into its program findings by the survey carried out by the CATIE watershed project in Central American countries, utilizing help from people directly involved in the survey for interpretation of the results. The team closely looked at the issues raised in the PID and in cables from the country AID missions. The many diverse views expressed by people in different countries and institutions present some difficulty in designing a program that can meet everybody's expectations. In taking a more global view of the expressed problems and needs, the many

diverse views can be seen as necessary components of a successful regional watershed project. Individuals stressed what they perceived as major needs without excluding existence of other needs.

The team developed a program that responds to the views expressed in key documents and to issues raised, that fits the goal and purpose statement and that stays within the budgetary limits established for this project. The proposed program represents a balance in meeting the expressed needs for long-term and short-term training, for country coordinators and for country specific programs. The appropriateness of the proposed project in terms of its components and their relative importance was substantiated in a meeting with AID mission representatives from Costa Rica, Honduras and Panama.

The intent of this project is to build a self-sufficient regional institutional program which can assume a leadership role for providing long-term and short-term training in watershed management, for giving technical advise and for promoting awareness of the importance of sound watershed management practices.

Three interrelated components make up the proposed project:

- Training
- Advisory and cooperative services
- Support services

The general structure of the project functions is shown below: (Figure 1).

Figure 1. Proposed Structure of Regional Watershed Project

TRAINING	SUPPORT	ADVISORY & COOPERATIVE SERVICES
. Graduate . Short-term	. Data Base Systems . Instructional Design. & materials Service	. Prototype projects . Develop Agency Training capabilities of national and regional institutions.
. Under graduate program support	. Project information service	. Develop undergraduate & technical education. . Technical Advise.
. Scholarships		. Data Base and information Services
. Awareness		

To carry out these functions, a team of specialists supported by short-term consultants, technicians and secretarial staff will be assembled at CATIE to work in all or some of the described functions. All specialists will be involved in training and advisory services. Two specialists, in data base/ information systems and institutional design and materials, will have major roles in supporting the latter two functions. These support services will be provided through a regional data bank to be establish at CATIE, an instructional materials and design system and the establishment of a project information office.

Organizational Overview

A team (7 long-term advisors and several short-term consultants) of specialists representing major aspects of watershed management will be assembled at CATIE for graduate training and outreach activities in the countries. The integrated nature of watershed management suggests close interaction and coordination of the multiple activities of the specialists. CATIE offers the infrastructure to incorporate these additional activities. It provides the best backup opportunity for the important support services function of the proposed program through its library facility and computer center. CATIE staff have experience in developing and putting on short-courses and carrying out other types of outreach activities.

The vast amount of research knowledge in major aspects of land uses of direct relevance for watershed management provides relevant information for the advising and training activities of the team of specialists.

The staff will be involved to varying degrees in providing input to the CATIE graduate program. On the average, less than one course (2 credits)per year per staff member has to be carried. All staff members also have direct input into short-term training. While all staff members have a substantial input into advisory services to the countries, their individual roles differ. Each specialist will respond to requests for help or information in his specific area of expertise. Some staff members will frequently be included into teams to deal with integrated watershed management questions such as in watershed planning exercises. In line with the support services function of the data base specialist and institutional design and materials specialist, these two individuals will have less graduate student advisory duties.

The program if carried out successfully will begin a process of raising the awareness of decision makers about the importance of watershed management. This will create job opportunities for the people trained through this program. The project will be able to extend substantial efforts to the countries in working on critical watershed problems and providing solutions to some of them.

Summary of Individual Components

Training Component

A detailed description of this component is contained in a consultant's report to USAID/ROCAP (Stevens 1983).

The role training must play in establishing or strengthening the training/education program in CAP expands upon the following elements:

- Strengthening the staff at CATIE and national institutions.
- Degree and non-degree training needs of the region.
- Curriculum development activities for institutions outside CATIE.
- Scope and mechanisms to be used for curriculum development.
- Human resources as well as hard and software needs.
- Proposed budget to support the recommendations.

A degree and non-degree training agenda has been designed for CAP to help strengthen the capabilities of national governments to properly manage their watersheds. There is a chronic lack of human resources and a weakness or total absence of an appropriate educational structure to plan or manage the watershed resources.

Schools are attempting to develop courses and programs in the natural resources area. However, these schools are small and produce few graduates and most cover a narrow band of forest and natural resources sciences. Education in watershed management can play an important role in modifying the traditional exploitive nature of forestry and other uses of renewable natural resources. The strategy recommended for USAID/- ROCAP support is the first phase of modifying and

introducing technology in watershed management to CAP. While the program to be established is located within the CAP region its effects will be felt throughout Latin America and parts of the Caribbean.

The objective of the training strategy is to strengthen and establish an education program which will have long lasting effect and be the foundation upon which the complementary soil and watar conservation ethic can be built and correctly managed. The scope combines a watershed management and scientists ecological knowledge and sensitivity with the social and economic development approaches of national planners and land developers.

Four groups have been targeted for training: (1) Senior Policy Level, (2) Senior Professional/Manager Level, (3) Professional Level and (4) Technician Level. Within the region it has been found that women play a catalytic role in the learning process. Therefore, priority consideration will be given to including women in the training strategy.

The training activities will directly strengthen the skills of over 900 participants. A degree program provides for assistance in higher education. These students will fill vacancies in country institutions and CATIE.

The non-degree program combines formal and informal exchange and application to theory. A post-graduate and visiting scholar fund provides degreed people the opportunity to update themselves and become prepared to absorb new tasks.

There are 10 short courses that are appropriate and will have a powerful long lasting effect. A description of these courses has been prepared. Workshops and seminars combine formal and informal exchange. The first conference will bring together senior policy level people to discuss regional watershed policy and direction. There is also a seminar involving the senior professional/manager group in basic management. These two key events scheduled for 1984 set priorities and discuss policy.

As appropriate and funds permit, scientists working on watershed management problems will be invited to attend information exchange activities. Study tours are included to give the opportunity to visit field sites or attend professional meetings.

It is recommended that a graduate program be substantially strengthened in watershed sciences at CATIE, Costa Rica. A

curriculum providing 45 credit hours of watershed management option has been designed for incorporation into the University of Costa Rica graduate program.

As part of strengthing the graduate program the project supports the establishment of an outdoor laboratory in the nearby Rio Tuis catchment.

Very high consideration will be given to allowing University credit for the technical short courses. For many, these courses will be the first introduction to the subject and may plant the seed for them to learn more about their water resources and how to manage them.

Training and technical assistance are the core of the project. Therefore, the project includes technical support in the form of training in data base services, instructional design and materials, project information, prototype watersheds, country coordinators and direct technical assistance. Refer to the definition of prototype watersheds page 13 in combination (the interelationship of) these project components will reinforce existing programs and projects rather than promote new ones this will avoid competition for scarce local resources and limited professional/technical staff.

In order to provide depth to the educational strategy it is highly recommended that a twinning program of cooperation be established between selected U.S.A. forestry schools and regional and national forestry schools for the purpose of strengthening these schools.

Advisory and Cooperative Services Component

Training and the technical assistance given by the staff members to the countries forms the core of the project. It is devoted to assisting the CAP countries in solving local problems and strengthening the national institutional structure. The training components just described cannot be effective by themselves; watershed management is an interdisciplinary effort. Therefore, the project includes technical support in data base services, instructional design and materials, project information, prototype watersheds, country coordinators and technical assistance. All of these services are directed to establish or strengthen country watershed management programs and field activities (which can be sustained). Specifically, the purpose of this program component is to establish a link between the training-education process and the in-country watershed management activities and to provide advice and cooperative assistance to the project

member countries for the strengthing of their ongoing watershed management efforts.

The key link between the CATIE staff and watershed management activities in the country will be the country coordinator. The coordinator, established in a key institution within each country, will carry out coordinating activities between the watershed management staff at CATIE and country watershed institutions and projects. They will play a decisive role in selecting people for out-of-country training, coordinate in-country training, channel information requests to the regional data bank, coordinate data collection activities at the country-level, identify opportunities for project input in prototype projects, and represent a clearing house for information.

Data Base Services

The establishment of a regional watershed management data bank as part of this project provides one of the support services that is principally directed at helping countries in planning and management of watersheds. This service is accomplished by responding to requests for information on varied aspects of watershed management with information summaries retrieved from a central computerized data base. Assistance will also be provided to strengthen local data base setups. It could be in the form of technical advise on developing a local data base and total or partial transfer of the data base to the countries.

Technical Advice

Much of the staff's time will be spent working with the countries advising and helping with the solution of specific technical problems. Advantage should be taken of the specialists' expertise as well as the short-term consultants which have budgeted for this purpose.

One of the aspects of technical advice will be to work with the country institutions to develop undergraduate and technical education. This project will not directly set-up institutes, but will advise on courses, sylabi and programs adaptable to national institutions. For example, many of the universities and technical schools now have the staff capability and desire to teach a general awareness course in management of watersheds.

Instructional materials: This project will be instrumental in developing and producing all kinds of course material, technical reports and manuals. It will have to be put into a form that is compatible with local conditions and language. Such activities will include assisting the faculty with short courses and workshop materials, design and writing of text materials, production of publications, helping with evaluating course material for revision, etc.

Most important will be assistance given to countries in establishing a timely delivery system for instructional materials.

"Prototype" watersheds: These watershed will be selected among country watersheds for specific input by the CATIE specialists. The prototypes will be selected preferably in on-going projects and from any type or size of watershed. These watersheds represent the training and proving ground where important national watershed management problems are studied and human and institutional capabilities are improved upon.

There is a real need for setting up these type of projects in each country of the region both as means of promotion and as away to put into practice different aspects of watershed management planning methodologies and applications (for further detail see: Dutchover 1983).

Some of these projects could also contribute to the strengthening of preferably ongoing efforts by CATIE and AID missions in the transfer of technology that could be applied to enhance watershed management in the region.

These pilot projects could meet different purposes, among them:

1) To strengthen ongoing field effort and reduce their t.a. costs and burdens.

2) To identify common and relevant watershed management problems of CAP.

3) To study problems, find solutions and promote technology transfer in country watershed.

4) To promote watershed management in one or more of the national institutions by generating interest through concrete applications of watershed management tools, allowing the local technicians to be an active part of the

process. Sometimes this will involve universities and demonstration watershed.

5) To collect and disseminate valuable information about the general and specific opportunities and limitations of various methodologies, techniques and treatment related to watershed management within the region.

6) To serve as a link with other components of the project such as data base generation and application, promotion and training.

7) To provide local demonstration, training and human resource development opportunities.

Land use applications will be practiced for research and demonstration purposes and valuable information collected. These watersheds will serve an important link to training functions. All graduate students will be required to do their thesis work on a problem related to the country prototype. In country technical short courses, workshops and seminars should use the watersheds as a basis for training.

Specific Products that could come out of prototype watershed Activities are:

1. A hydrologic information network which allows the application of techniques to help the design and planning of small scale water resources development projects. The network will include data base methodologies as part of planning.

2. A watershed planning methodology that could be the basis for key watershed efforts in member countries of CAP.

3. A valley cooperation project where planning objective are to consolidate the efforts of various land uses of both the lowlands and uplands. The planning and implementation strategy would include agrosilvopastoral treatment aimed to study not only their socio-economic implication, but also their effectiveness in soil and water.

4. Promote and strengthen ongoing efforts in international wathershed management.

5. Technology transfer opportunities.

6. As part of strengthening the Graduate Program the project will support the establishment of an equipped outdoor

laboratory in the Rio Tuis catchment near CATIE. This outdoor laboratory will serve to demonstrate the use of equipment, measurement, collection, evaluation of land use response to different practices and as a control to other research by the students and faculty. A well equiped climatic station is on the CATIE campus which will provide a data check.

Program Support Services

Data Base/Information System Component

A detailed description of this component can be found in a consultant's report submitted to USAID/ROCAP (Rose 1983d).

The establishment of a regional data base/information system will provide one of the important service functions of the program. It will directly serve the countries, i.e., institutions and specific projects, by providing administrative, social, economic and technical data for regional and national planning and management operations. It will also support various functions, long-and short-term, in the training programs and provide the permanent advisory team with backup data and information.

In developing a strategy for the data base information systems component of the program, the background information provided by the various documents together with survey findings (CATIE, Watershed Project 1983) were very useful. It provided answers to which key groups would need specific information, to what kind of information was most needed, to the needs for training to use information and to the priority of services of a central data bank.

The general strategy that envolved involves establishing a central data base/information service for the region with the purpose:

> To serve as a regional center for collection, storage and dissemination of information to planning offices, watershed projects and institutions involved in watershed management activities.

The major functions envisioned for the regional watershed management center at CATIE are:

(1) Organize regional information useful in major aspects of watershed management planning.

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(2) Design central information storage and retrieval system.

(3) Respond to information requests.

(4) Advise countries on data collection needs and help coordinate collection efforts.

(5) Develop uniform data recording forms and train country personnel in use of forms and data entry.

(6) Advise in organization of data bases of research fields important to watershed management.

(7) Advise in establishment and assist in the further development of in-country information storage and retrieval systems, e.g., the data base/information components identified in the AID funded National Resources Projects in Honduras and Costa Rica.

(8) Train coordinators in data retrieval.

(9) Contribute to training of graduate students and short-course participants in use of data in decision making and planning.

To promote the use of the central organization, the data base specialist should put early emphasis on development of products considered useful by potential users of the data bank before asking for the cooperation of country institutions in data collection.

To facilitate this rapid development of various products, advantage should be taken of existing capabilities at the computer center in terms of available computer packages for word processing, geographic information systems and data base management and of personnel.

Priorities must be set for the production of outputs and for the services of the regional data bank. Collection of data and information on critical watersheds must receive a high priority. At the same time information must be collected to help identify high priority watersheds. A number of specific products that could be developed are:

- Computerized reference library representing a collection of documents most useful in watershed management planning and operations activities. Distribution and mailing of materials should be coordinated with INFORAT which already is serving this function.

- Map and photo collection in combination with a computer based indexing system for quick information retrieval on available maps and their content.

- Computerized geographic data base system using the existing CRIES capability at CATIE.

- Data base management system for regional and national information useful in watershed management planning and operations. This data base could include descriptive tables of institutional activities in watershed management, watershed descriptive tables, land utilization information tables, watershed management information tables and tables with information supporting land use decisions.

Information Transfer:

In accordance with the role of a regional data bank, mechanisms must be set up to respond to information requests by national institutions. This includes:

1) Design data bases and retrieval procedures.

2) Design simple request forms for retrievable information.

3) Promote use of center's services by mailing filled sample request forms and associated information summaries retrieved from data bank to country coordinators and key institutions. Supply simple instructions for filling out requests and blank requests forms.

4) Fill requests when received at center.

5) Develop a service fee structure.

6) Advise on in-country data base design and installation.

To respond to information requests on a timely basis, the project will develop word processing capabilities. The storage of text and data would be handled by the existing computer. The highly flexible word processing program SCRIPT (SCRIPT 1979) is already available on CATIE's computer.

Role of Data Base/Specialist in Training

A course "Principles of Data Base Management and Computer Applications" is designed for applications of statistical analysis programs and data retrieval programs. This will

provide exposure to basic principles of data handling to students in the watershed management curriculum and generate a general awareness of the utility of organized information sources. Students will also be exposed to data base/information problems in integrated planning exercises of courses in "Principles of Natural Resource Economics" and "Land Use Inventory and Planning".

Country coordinators will be trained in two aspects of data base management. One is the ability to retrieve information from the system. The second training program will introduce the data base design to the coordinators and selected technicians and train them in data collection, using data collection forms developed by project specialist, and data checking and processing.

The centralized data base will play a major role in training and promotional activities. A short-course developed for training of planners and decision makers might develop practical exercise in decision making that are supported by only conventional data by an organized data base.

To facilitate the incorporation of data into economic decision making modules, a computer program developed by Rose and Gregersen (1980) is available on the CATIE computer (Rose 1983c). This program could be incorporated into the courses "Principles of Natural Resource Economics" and "Land Use Inventory and Planning", as well as short courses for planners and decision makers

The specialist together with the instructional materials specialist and computer center staff will carry out or coordinate the training of secretarial staff on the word processing system.

Role of Country Coordinator in Information Retrieval and Data Collection

Coordinators set up in a key institution should serve a dual role. For one, they should prepare requests for information for any institution which needs this service. Their second role will be to keep the data bank administrator advised of new watershed management projects as potentially new data sources and to periodically provide updated information to the data bank specialist.

Cooperation in information collection activities and coordination of this effort among institutions can only be achieved by a successful promotion of the utility of a central

data bank. Much of the initial effort in establishing this information base and of logically organizing the role and potential contributions of country and regional institutions must be placed into the hand of the data base specialist.

The coordinator should also identify needs for technical advise by the data base specialist in the establishment of in-country data bases and retrieval capabilities. Opportunities for such technical assistance exist for example in the AID funded Natural Resources Projects of Honduras and Costa Rica which have a data collection/information component.

Coordination with Computer Center and Other Projects

Demands on the staff of the computer center are high. The center's staff will not be able to provide substantial time in support of the data base specialist. It is, therefore, highly desirable to contract a person who has experience with the VM operating system and with computer programming. The IBM 4331 system is easy to operate and should require a person, familiar with computer operations, only a minimum of time to be able to run the system.

In line with the recommendation that the data base specialist position and the technical support would be carried eventually by CATIE's core budget, the specialist should begin coordinating activities with other projects at CATIE. This role would involve promoting organized data collection and storage and advise on how to design project specific data bases.

The development of the data base capabilities of the watershed management system will require a number of structural changes in the operation of the CATIE computer center.

Equipment Needs for Data Base/Information System

The functions and products and services envisoned for this project component will add substantial demands for personnel and equipment and some requirements for extra space.

The IBM 4331 computer at CATIE is currently being used for the task of data base management. A serious technical limitation is the lack of sufficient central memory space for running large data bases. The proposed watershed management data base system can not be handled by the current system without severely interrupting work of other projects and will, therefore, require purchase of disk space and resetting of the system to optimize the operation. For the proposed central data base, storage of data on tape and tape to tape transfer of

data is necessary. This operation will require the purchase of an additional tape drive or the replacement of the current, unreliable single drive by a faster twin-drive unit.

To upgrade the CRIES system, purchase of a digitizer, plotter and terminal is required. To complete the word processing capabilities for the project, the purchase of a high quality printer is recommended as well as the purchase of several terminals. They will serve as word-entry stations for secretarial staff, for instructional use, for data base functionas and instructional materials design functions. To efficiently support and process the additional workload of the computer center with the addition of a digitizer plotter and additional terminals, acquisition of a control unit as well as augmentation of processor capacity are necessary.

Operations Considerations Including Staffing

Space is at a premium at the current computer center. Installation of some additional equipment within existing facilities is feasible. It would include additional disk storage, a high quality printer, digitizing equipment and plotter. Beyond this, additional terminals for the project should be installed in the project offices, connected to the center by cable.

The data base specialist will come on board 6 months after the arrival of the project administrator. This early arrival will provide some time to organize some of the available information that staff teams will require to give technical advise. The specialist will be supported by a full-time technician who will be responsible for data entry and retrieval functions. The staff specialist will also train the technician in all aspects of management of an information system.

Instructional Design and Materials Component

A consultant report submitted to USAID/ROCAP contains a detailed description of this component (Hodgson 1983).

The instructional design and materials (IDM) activities contribute to the project goal by expanding the abilities of the training and advisory and cooperative assistance activities to reach a larger and wider audience and to improve communication and instructural effectiveness.

The IDM element achieves its purposes by providing the following services.

- Conducts training and provides advice and cooperative assistance to enhance the training capabilities of organizations doing watershed management.

- Develops prototype teaching units and provides advice to encourage inclusion of watershed management subject into existing undergraduate and technical school resource management courses.

- Prepares instructional designs and acquires or produces instructional materials supporting short term training activities.

- Identification and acquisition of existing instructional designs and materials that can be adapted for use in project activities.

- Design and modification of instructional activities and materials.

- Production and reproduction of instructional materials.

- Delivery and circulation of instructional designs and materials.

- Maintenance, repair, and replacement of instructional materials and media.

- Evaluation of the instructional effectiveness of instructional designs and materials and delivery systems.

- Revision of designs, materials, and systems as indicated by evaluations and other feedback.

Organization of IDM

The IDM element is under the direction of an IDM specialist who reports to the project director. The specialist supervises a technical writer, one one-half time journalist, one draftsman/artist, and one technician. The draftsman/artist will be housed with the Produccion de Medios Audiovisuales. The 50 percent journalist will be housed with the Oficina de Relaciones Oficiales e Informacion. The technician will be housed there also. The technical writer should be located near the specialist because the two will have to work closely together.

The IDM specialist will develop close links to country coordinator and will assist them to organize and operate their portions of the delivery, distribution, maintenance, repair, and replacement systems.

Because the project information office will be located with the existing Oficina de Relaciones Oficiales e Informacion, special care must be taken to integrate the actions of the watershed management project information activities and those of the Oficina. Excellent economies of scale should be possible but the chance for confusion or conflict exists.

Specific recommendations that should facilitate job organizational are:

a. Instructional materials and media should be durable and easy to maintain and repair. Replacement costs should be low. On the whole, an effort should be made to keep materials and systems simple to understand and use. An emphasis on print media seems most appropriate at this point but more detailed analysis may yield different conclusions.

b. Production at CATIE should generally be limited to the camera ready/production script stages. Printing and production beyond that should be contracted to capable enterprises and organizations many of which exist in Costa Rica.

c. Special attention and time should be devoted to the analyses phases of the various activities. The preparation, motivations, attitudes, and environments of learners will vary across Central America and Panama. Cultural and other differences may make some instructional design principles based on North American and European research inapplicable. It will certainly call for a variety of approaches directed to defined audiences.

d. The IDM specialist should seek ways to recover some production costs and acquire additional support for IDM activities. The budget is adequate to launch a significant effort in instructional materials and designs in the region but full benefits will only be experienced if the level of effort can be expanded and extend.

e. As better information is gathered through audience analyses and communication system analyses, the specialist should expect to modify the plan as formulated here. Probably several adaptations will have to be made and some assumptions may not hold up. Also, because conditions vary throughout the region, designs and materials probably should not be uniform for all situations.

f. Much experience has been gained in training in CAP countries by many agencies and projects. The specialist should very early collect and synthesize that experience in order to build on the past.

SELECTED OUTPUTS OF THE INSTRUCTIONAL DESIGN AND MATERIALS ELEMENT AND APPLICATION

Instructional Designs and Materials	Applications
Instructional Strategies	
- Course outlines-	Graduate courses
- Instructional activities-	Prototype teaching units
- Etc.	- Short-term training activities
	- Self-spaced study programs
	Others to be determined
Text Materials	
- Syllabics	- Graduate courses
- Adapted texts	- Prototype teaching units
- Revised texts	- Short-term training activities
- Original texts and supplements	- Self-spaced study program
- Etc.	- Field manuals and technical guides independent use

Instructional Designs and Materials	Applications
	- Awareness activities - Advisory services - Project information Handouts - Others to be determined
- Audio-Visual Productions - Slide tapes - Film strips - Television programs - Radio programs - Motion pictures - Etc.	- Graduate courses - Prototype teaching units - Short-term training - Awareness activities - Others to be determined
Press Releases - Public Service Annoucements -- radio -- television - News Releases - Press Conferences - Program Appearances - Etc.	Awareness Activities - General public/land users - Professionals - Decision makers
Participation in Conferences - Scientific and Technical Papers and presentation - Displays & Poster Papers - Issue Papers - Etc.	Awareness Activities - Potential funding sources - Potential contributors of expertise (sabbatical faculty, etc.) - Professionals - Decision makers
Articles and Letters - to popular science magazine - to professional journals - to general-interest periodicals - to trade journals - Etc.	Awareness Activities - General public/land user - Potential funding sources - Potential contributions of expertise (sabbatical faculty, etc.) - Professionals - Decision makers
Displays and Demonstrations - at local fairs (turned) - at CATIE - Etc.	Awareness Activities - General public/land users - Visitors interested in the project - Others to be determined - Short-term training activities

Project Information Office

Experience with other successful projects at CATIE, such as the LENA project, has demonstrated that a heavy demand for information about the project develops after a year or so of operation. That demand has overburdened the specialist staff in many cases detracting seriously from their work. The result is an inefficient use of scientists.

At the same time, the scientists are not trained in press relations and visitor information services. As a result, the communications about the project are less effective than they might be.

The visitor information, awareness, press relations, and public input functions are too large on this project to be handled on an ad hoc basis. Failure to accommodate this need will substantially decrease the project's effectiveness and endanger the prospects of continuing the work that is begun beyond the funding period. The project information office (PIO) will serve to:

1. Assist the press, visitors, and other interested people to acquire complete and accurate information about the watershed management training project.

2. Help specialists make efficient use of their time by protecting them from excessive demands for routine information.

3. Increase awareness of the project worldwide among representatives of potential donor organizations with the objective of attracting support to help continue the project's activities after the project funding ceases and to increase the project's efforts beyond the limits imposed by the funding level.

4. Promote awareness of the contribution of sound integrated watershed management to the economic and social welfare of the people of CAP.

The following are possible activities of this office:

1. To write, prepare, and publish descriptions of the project's activities. These may be newsletters, brochures, or other documents depending on the specific audiences, the topic, and the objectives.

2. To write and see to the publication of articles for conservation magazines and similar outlets describing elements of the project.

3. To identify international and national meetings where papers might be presented describing elements of the project, people within or outside CATIE who might present such papers, encourage them to participate, and assist with the preparation of papers and presentations.

4. To prepare press releases and manage press relations so that the activities of the project are accurately, frequently, and completely covered.

5. To see to the preparation of one or more audio-visual programs describing the activities and purposes of the project to be used principally to introduce visitors to the project at CATIE. These AV programs need not necessarily be limited to slide-tape formats.

6. To arrange tours, both for individual visitors and for organized groups to show the kind of work being done by the project. Demonstrations of the data base system, visits to the demonstration/training watershed, and presentations of some of the teaching materials may be appropriate.

7. To serve as a gate keeper, insuring that inquires about the project whether through correspondence or in person are promptly, accurately, and completely answered and that access is maintained to the staff while at the same time protecting the specialist staff from an overload of information demand.

8. To identify opportunities to inform and involve opinion leaders in government, industry, education, and society with watershed management through tours or other appropriate means.

9. To assist the project leader and the country coordinators to inform the personnel of cooperating and impacted agencies and organizations of the project's activities and involve them in meaningful ways in decisions about project activities. It is vitally important that this communication link be two-way.

10. To provide instruction to country coordinators on the planning, logistics, and management of meetings, training sessions, study tours, and other instructional and awareness activities. This may include preparation and publication of a guidebook or manual for coordinators.

11. To provide instruction to country coordinators on press relations, preparation of media releases, and the principles of public information activities. This may include preparation and publication of a manual on press relations and public information.

12. To devise methods of evaluating the effectiveness of the activities of the project information office and of awareness activities conducted by other elements of the project and see to the administration of those methods and the analysis and interpretation of the results.

13. Assist with the preparation and reproduction of project evaluation reports.

14. See to a complete photographic and verbal documentation of the project's activities and the development and maintenance of a captioned photographic collection for use in press relations, publications, awareness activities, and evaluations as well as a historic record of the project.

15. To conduct other information and awareness activities as appropriate to achieve the purposes of the project information office.

This information distribution activities of the PIO should be considered with INFORAT in cases of scientific reports.

Organization of PIO

The instructional design and materials specialist will be responsible for the activities of the project information office. Approximately 20 percent of the specialist's time should be devoted to this element.

The PIO will be attached to the existing CATIE Oficina de Relaciones Oficiales e Informacion. A writer/editor will be employed one half time to develop materials and handle press relations. A clerk/guide will be employed one half time to handle routine correspondence, schedule appointments and tours, guide tours, see to the maintenance of audio-visual programs, and perform such other duties as are assigned by the specialist. Word processing and other services needed to prepare publications and correspondence will be provided by typists and technicians assigned to the instructional design and materials element unless other arrangements are made by the specialist or project leader.

Production

Printed materials will usually be prepared to camera ready copy at CATIE and the printing contracted. Audio-visual programs will usually be prepared to the level of a production script (graphics included) at CATIE and the production and reproduction contracted. Variations in these models will be made by the specialist when appropriate.

Whenever possible, the PIO should arrange coverage by the press and the production of programs by the press rather than producing public service announcements for distribution. This approach is expected to be less expensive and to generate greater awareness among the press and the public.

Equipment

One self-contained, slidetape playback unit will be required to show the slide-tapes prepared for visitors to CATIE. Other equipment needs will be shared with the instructional design and meterial element.

Travel

Very little travel is expected to be directly related to the work of the PIO. Most travel related to press relations and awareness activities is expected to be done by or on behalf of the country coordinators. Other travel will be in conjunction with training activities.

It will be necessary to budget approximately $1,500 per year in the last three years of the project for local transportation related to demonstration of project activities to CATIE visitors.

COORDINATION WITH OTHER CATIE PIO ACTIVITIES

Certain economies of scale can probably be experienced if the PIO activities of the watershed project are coordinated with those of other projects such as the LENA project. The IDM specialist and the project coordinator should explore ways to cooperate and possibly consolidate some activities. For example, some writer and technician salaries might be shared.

II-B CATIE's Plan to Cover Costs and Continue Activities After the PACD

This project is considered as the first phase of what will be a considerably longer-term effort involving the national resource management planning and educational institutions, CATIE and a broad range of international and bilateral technical and financial support agencies and institutions.

Replicability of the project will depend upon demand by the countries for training, advisory services, and information materials and processing and CATIE's ability to provide those by maintaining a staff of key watershed management specialists and activities, funded by a combination of CATIE's core budget, fees to be charged for services provided and other new sources of funds at the international and bilateral level. CATIE's experience with other projects of similar design, particularly its seven year old, Regional Wildlands Management Project, has demonstrated amply that such replicability is almost certain to occur if this project accomplishes its main objectives.

The problems associated with watershed mangement have just begun to enter a critical phase in the region and the situation in the future will tend to get much worse unless enough people are properly trained to handle the conservation and management problems at all levels. Therefore, the future demand for training should be high and sustained for many years to come if successful programs, with support at different levels, are to be started or maintained. Training at the extension level will become of great importance in the future.

There is no doubt that a project like this will consolidate the awarenss and concern for watershed management and that the demand for training, advisory services, and information handling and processing will expand. The need to protect the high investments of water resources development projects, actions to avoid further deterioration of water regimes and quality, and the pressures to mitigate further erosion of valuable and scarce soil resources will force national and international institutions which support projects that involve natural resources to invest large amounts of money into conservation, protection and rehabilitation schemes. This will require well trained personnel at all levels.

From the financial point of view, CATIE's location, infrastructure and training and advisory services capabilities will become very valuable assets which should provide high monetary returns.

Although it is now difficult to numerically estimate the future demand for different training activities or for the data base analysis and advisory services, it is obvious that the exposure this project will have during its five year life will be enough to induce an adequate demand for services. Therefore, it is expected that graduate and short courses fees and charges for advisory services and data base information and analysis should draw enough income to pay for the operation and maintenance costs plus the salaries for most of the future permanent staff.

As the project gains exposure and its staff's experience and expertise increase, CATIE will begin to charge a fee for many of the services and training activities, both to donor organizations and national institutions. Initially no fees will be charged since it will be necessary to demonstrate, first, that the services are essential to the development plans and projects of the region (in a sense this will be part of the awareness building program), second, that the potential savings warrant paying the costs of the services and, third, that CATIE can provide them. Likewise, as the project demonstrates its ability to provide effective training and other services, donor agencies of all types and national institutions will begin to more and more use those services and program them into their projects the funds necessary to pay for them.

It is also very important to recognize that the project design has built in a number of mechanisms to cut down costs dramatically as this first phase of five years is executed:

1. Of the core professional staff of seven senior specialists and five junior ones, CATIE will be covering the salaries of two senior and one junior specialist out of its core budget during the life of the project.

2. Junior staff will receive on-the-job training and additional graduate level training so that they will gradually replace senior staff during the life of the project. Thus, in its early years, the project will have a staff larger than CATIE expects to maintain on a permanent basis. Consequently, the future costs to CATIE will be less than the costs associated with this project. By the end of the project the rest of the core staff needs should be for th other five senior staff,most of whom will have been replaced by less costly junior staff, and approximately three junior staff assistants. CATIE will program to cover at least

three of those senior staff and two of the assistants out of core budget by year six. The others will be covered by income generated from services provided.

3. The initial high investment in data base and instructional materials equipment and design will allow the production of related services at minimum costs once the national personnel trained under this program replace the extensive international staff.

4. The preparation of instructional materials in modular form for most short courses and many graduate courses will provide a very valuable commodity to be offered to the regional, national and international "market". CATIE's comparative training advantage in terms of appropriateness, costs, and language, and the uniqueness of its watershed program will expand the market for graduate and short course training in CA/P and the rest of the Latin American region.

5. The research data and practical management experience derived from the in-country long-term, ongoing projects plus the software capability generated throughout the life of the proposed project, will offer a unique opportunity for data base and advisory services in the humid tropics.

Experience with the Wildlands Management Project and other similar activities have demonstrated that this scenario can be expected to occur. The demand by the CA/P countries for its services has become very high over the past seven years as a result of a smallar project (Wildlands) designed in a very similar manner to this one.

In the Wildlands Management Project CATIE itself is paying the costs of one senior and one junior specialists from basic budget (since 1980). However, the demand for advisory services and training has reached such proportions that an additional two senior staff members and two junior ones are being added (1983-84) covered by income generated by advisory services and a training program provided to the countries. Likewise over 90% of all operational costs (training events, travel, supplies, equipment, etc.) is being covered by income thus generated. The sources of those funds are national resource management institutions and a wide array of international and bilateral donors (UNESCO, UNEP, IUCN-WWF, AID, DDA, FAO, IDB, etc.). Thus, of a total annual Wildlands Project budget of over $400,000, CATIE is financing only $60,000 from core budget; the rest is covered by funds provided for services rendered.

The mechanism of the Wildlands Management Project will be taken into account when CATIE formally intalls a mechanism to charge fees in the fourth year of the project (see Financial Analysis pages 62-63). Efforts to obtain funding from other donors (IDRB, IDA, bilateral USAIDs, etc.) will begin early in the life of the project. The integrated approach of the project and the establishment of national advisory committees and a regional advisory committee which will purposely include participation by other donors will greatly assist this process.

II-C Staff Job Descriptions: CATIE

General

Senior Professional Staff should hold the degree of Ph.D., or, in some cases, M.S. with extensive experience in their field, or have other equivalent qualifications to such degrees and experience. They should also have considerable experience and exceptional capability in their field in work in LDC's (in some cases specifically, in the Latin American region), and should have an appreciation of and a commitment to interdisciplinary planning, execution and analysis of integrated watershed management projects, programs and research not only within the CATIE project group, but also in collaboration with the technical personnel in cooperating national institutions. Likewise, they should have extensive teaching experience at the graduate level and preferably of the short-term training type also. All must be fluent in Spanish.

The Junior Professional Staff (Chief Assistants or Technicians) should have the M.S. Degree in their field of specialization or equivalent experience, have at least several years experience in their field, and have some experience in teaching at the university level and preferably in short-term type training. All will be Latin Americans, if possible, and thus fluent in Spanish.

Detailed descriptions of each position follows:

Specific

1. Project Manager (Watershed Mangement Specialist):

   A. Qualifications — Doctorate degree in Watershed Management or in a related water resources field, or with equivalent experience, and at least 5 years as a teacher at the university level. Experience in curriculum development and in the organization and execution of short-term training is highly desirable. Must have administrative and project coordination background and at least 3 years experience in Latin America, preferably in the Central American Region. Watershed background should be oriented to planning, politicy and/or economics. Fluent in Spanish.

B. Duties: 1) Plans and implements the projects activities in coordination with the wildlands and Watershed Program, Renewable Natural Resources Department (DRNR), the Graduate Studies Program, and CATIE's other Departments.

2) a. Directs project professional and technical staff.

b. Directs project administrative and support staff.

3) Directs project activities.

4) Directs and coordinates the Country Coordinators.

5) Supervises the monitoring and reporting on project activities.

6) Teaches the graduate courses in Watershed Management Planning and Application (jointly with the Land Use Specialist) and Principles of Watershed Management.

7) Advises at least one graduate student per year and serves as a member of the graduate committees for two more students per year.

8) Supervises and collaborates in the preparation of instructional materials in his/her field of expertise, especially training manuals and teaching modules for both the short-term training events and graduate courses.

9) Supervises and gives overall direction to the graduate program and all elements of the short-term training and non-degree program.

10) Organizes and directly coordinates the execution of several elements of the training program: specifically the graduate degree program, short-term non-degree fellowship program, visiting scholar fund and study tours.

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11) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the visiting scholar fund, study tour fund or short-term non-degree fellowship program.

12) Acts as chief organizor and coordinator of the Watershed Planning, Programming and Implementation short courses and the Senior Professional Basic Management Seminars, and teaches in several other short courses, workshops and seminars.

13) Supervises the provision of advisory services to the countries.

14) Accounts for project budget and funds.

2. Land Use Specialist (CATIE Counterpart for the project)

A. Qualifications

Ph.D. or equivalent experience in land use planning or a related field, with extensive knowledge of the principles and practical application of inventory, classification and planning methodologies and technologies. Extensive experience in LDC's in that field, preferably in Latin America. At least 4 years experience teaching at the university level and experience in curriculum development and short-term training is highly desirable. Spanish fluency or near fluency required.

B. Duties

1) Acts as the Deputy Project Manager and replaces the Project Manager during the latter's absences.

2) Assists the Project Manager in the planning, implementation, supervision and direction of all project activities and personnel and assists him in all other aspects of project management and administration.

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3) Organizes and directly coordinates, under the Project Manager's overall supervision, the monitoring and reporting on all project activities, the technical short courses/workshops/seminars elements of the training program and the provision of advisory services to the countries.

4) Supervises the design, planning and operations of the Rio Tuis experimental watershed/outdoor laboratory.

5) Aids the Data Base Management Specialist and National Resources Economist in the design and implementation of the central data base management system at CATIE and similar national level programs.

6) Teaches the graduate course in Land Use Inventory and Planning Techniques (with the aid of several other staff members) and jointly teaches the graduate course in Watershed Management Planning and Application with the Project Manager. Assists on a limited-time basis in the teaching of three other graduate courses: Principles of Natural Resources Economics, Principles of Data Base Management and Computer Applications and Planning and Management of Wildlands.

7) Advises at least one graduate student per year and serves as a member of the graduate committee of at least two more students per year.

8) Supervises and collaborates in the preparation of instructional materials in his/her field of expertise, especially training manuals and teaching modules for both the short-term training events and graduate courses.

9) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the visiting scholar fund, study tour fund or short-term non-degree fellowship program.

10) Acts as the chief organizer and coordinator of the Large-scale Integrated Watershed Planning technical short-courses and collaborates in the preparation and teaching of several other short courses, workshops and seminars.

3. Land Use and Integrated Watershed Management Technical Assistant

A. Qualifications M.S., or equivalent experience, in an area such as watershed management, geography or forestry, with a strong background in land use planning. Experience in cartography and photointerpretation. Remote sensing training and experience is highly desirable. At least three years of work experience in his/her field. Some teaching experience is desirable. Reasonably bilingual.

B. Duties

1) Assist the Project Manager and the Land Use Specialist in all aspects of their technical duties.

2) Assists with both the graduate courses and short-term training events related to integrated watershed management and land use planning.

3) Aids the graduate students and special students in their thesis work or special studies in those aspects related to his/her field of expertise.

4) Aid in the preparation of materials (publications, manuals, etc.) related to the integrated watershed management and land use graduate courses and short-term training events.

5) Participates in the field management and research activities to be carried out at CATIE's outdoor laboratory/experimental watershed (Rio Tuis).

6) Aid in the carrying out of advisory services in the countries in his/her field of expertise.

4. Soil and Water Conserevationist

A. Qualifications Doctorate or equivalent experience in soil and water conservation planning and technology and extensive experience in applied soil and water conservation practices in tropical environments. Strong background on soil erosion research and management practices. At least 5 years teaching experience with ample extension background. Fluent or nearly so in Spanish. Field experience in Latin America highly desirable.

B. Duties

1) Assists the Project Manager and Land Use Specialist in planning, implementing and monitoring all project activities in his/her area of expertise.

2) Teaches the graduate course on Soil and Watershed Conservation Practices and assists with the physical aspects of the Soil Science graduate course.

3) Advises 2-3 graduate students per year and serves as a member of the graduate committees for another 2-3 students per year, as time permits.

4) Supervises and collaborates in the preparation of instructional materials in his/her field of expertise, especially training manuals and teaching modules for both the short-term training events and graduate courses.

5) Organizes and coordinates the Fundamentals of Applied Soil and Water Conservation Technology short courses and the Central America Watershed Management Workshop and teaches in several other short-term training events.

6) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the visiting scholar fund, study tour fund or short-term non-degree fellowship program.

7) Aids the Land Use Specialist and Country Coordinators in the design and execution of advisory services in the countries and the development of country activities in his/her field of expertise.

8) Aids the Hydrologist in the design and execution of planning, research and extension activities in the Rio Tuis outdoor laboratory/experimental watershed.

9) Performs other functions as may be assigned by the Project Manager.

5. <u>Hydrologist:</u> (CATIE counterpart for the project)

A. <u>Qualifications</u> Doctorate or equivalent experience in hydrology, hydraulic resources or a similar field. Extensive experience in hydrological research and its application to managing, planning and implementation (corrective measures, flood control, soil and water

conservation treatments) of watershed projects. At least 4 years university teaching and curriculum development experience. Experience in short-term type training desirable. At least three years experience in Latin America and fluent in Spanish.

B. Duties

1) Assists the Project Manager and Land Use Specialist in planning, implementing and monitoring all project activities in his/her field of expertise.

2) Teaches the graduate courses on Elementary Hydraulics and Watershed Hydrology and aids on a limited basis with the teaching of two other graduate courses: Watershed Management Planning and Application and Soil and Water Conservation Practices.

3) Jointly with the Natural Resources Economist organizes and coordinates the Seminars in Watershed Sciences for the graduate program.

4) Advises 2-3 graduate students per year and serves on the graduate committees of 2-3 more students per year, as time permits.

5) Supervises and collaborates in the preparation of instructional materials in his/her field of expertise, especially training manuals and teaching modules for both the short-term training events and graduate courses.

6) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the visiting scholar fund, study tour fund or short-term non-degree fellowship program.

7) Organizes and coordinates the Natural Resources Policy Seminar for Decision Makers and aids several other senior staff in organizing and coordinating several of the technical short courses, workshops and seminars, particularly those on Large-scale Integrated Watershed Planning, Watershed Planning, Programming and Implementation and Fundamentals of Applied Soil and Water Conservation Technology.

8) Aids the Project Manager, Land Use Specialist and Country Coordinators in the design and execution of advisory services in the countries and the development of country activities in his/her field of expertise.

9) Directs and coordinates the design and execution of planning, research and extension and other management activities in the Rio Tuis experimental watershed/outdoor laboratory, with the aid of the Soil and Water Conservationist.

6. Hydrology and Soil and Water Conservation Technical Assistant (CATIE counterpart personnel for the project).

A. Qualification

M.S. or equivalent experience in a field such as hydrology, hydraulics, oil and water conservation or civil engineering. At least five years experience in his/her field including topographic surveying and hydrometeorological instrumentation. Teaching experience desireable. Reasonably bilingual.

B. Duties

1) Assists the Hydrologist and Soil and Water Conservationist in all aspects of their technical duties.

2) Assists with both the graduate courses and short-term training events related to the fields of hydrology and soil and water conservation technology.

3) Aids the graduate students and special students in their thesis work or special studies in those aspects related to his/her field of expertise.

4) Aids in the preparation of instructional materials related to the graduate courses and short-term training events in his/her field of expertise.

5) Participates in the field management and research activities to be conducted at the Rio Tuis outdoor laboratory/experimental watershed.

6) Aids in the carrying out of advisory services in the countries in his/her field of expertise.

7. Natural Resources Economist

A. Qualifications A strong academic background in natural resources and economics is essential. A Ph.D. in one of these areas is highly desirable. Total experience should be at least 5 years with 3 years in project development and analysis work. Teaching experience at the university level should be extensive, with teaching in short-term training events being desirable. Experience in watershed management would be desirable but not necessary. At least two years experience in Latin America and fluency in Spanish.

B. Duties 1) Assist the Land Use Specialist in monitoring and gathering information on all project activities and preparing all regular progress and annual reports.

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2) Assists the Project Manager and Land Use Specialist in all aspects of project planning, analysis and evaluations.

3) Works with the Data Base Managers to develop appropriate inputs for economics analysis and systems programs for economic analysis.

4) Teaches the graduate course on Natural Resources Economics and possibly another course on Project Planning and Policy Analysis. Assists in the teaching of the graduate courses on Land Use Inventory and Planning Techniques and Wildlands Planning and Management.

5) Advises at least two graduate students per year and serves on the graduate committees of at least 2-3 more students per year.

6) Supervises and collaborates in the preparation of instructional materials in his/her field of expertise, especially training manuals and teaching modules for both the short-term training events and graduate courses.

7) Organizes and coordinates the Seminars in Watershed Sciences for the graduate program, jointly with the Hydrologist.

8) Supervises and acts as on-the-job trainer during the last six months of his/her contract for the national type professional Natural Resources Economist who will serve as his/her replacement.

9) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the visiting scholar fund, study tour fund or short-term non-degree fellowship program.

10) Organizes and coordinates the Tropical Watershed Workshops and collaborates in the organization and teaching of several of the short-term training events, particularly the technical short course on Data Base Management, Large-scale Integrated Watershed Planning, Analysis and Evaluation of Projects and Project Proposal Preparation.

11) Aids the Project Manager, Land Use Specialist and Country Coordinators in the design and execution of advisory services in the countries and the development of country activities in his/her field of specialization.

12) Assists in the design and execution of planning, research and extension activities at the Rio Tuis outdoor laboratory/experimental watershed.

8. Natural Resosource Economist (Replacement)

A. Qualifications M.S. in Economics. A good academic background in natural resources or natural resources economics is necessary. Two years university-level teaching experience and some practical experience in project analysis and evaluation is highly desirable. Fully bilingual, and ready to accept a six months to one year strong training in natural resources economics in a U.S. university, prior to assuming duties at CATIE.

B. Duties 1) Serves as a counterpart of and assists the Natural Resource Economist in all his duties during first six months of work at CATIE, after returning from specialized study in the U.S.

2) Performs all the same duties as described for the Natural Resource Economist, after taking over the position (after a 6-month apprenticeship).

9. Data Base Management and Information Systems Specialist

A. Qualifications A Doctorate degree or equivalent in a quantitative area such as statistics, computer science, operation research or quantitative analysis, with at least one additional degree in natural resources. At least three years of teaching experience at the university level. Trained in data base management or with substantial experience, knowledge of at least one programming language, background in statistics including sampling. Experience in Latin America is desirable but not essential. Fluency or nearly so in Spanish.

B. Duties

1) Assists in teching the graduate statistics course.

2) Teaches the graduate course in Principles of Data Base Management and Computer Applications.

3) Contributes to courses in Natural Resource Economics and Land Use Inventory and Planning Techniques.

4) Collects and screens information to design the centralized watershed management data base system for the CA/P countries.

5) Develops the information request forms and retrieval programs.

6) Designs data collection forms for country use.

7) Organizes, coordinates and teaches the short course on Data Base Management Systems.

8) Organizes, coordinates and teaches the short courses in countries on data collection, use of data forms and data entry (Data Base Numeration) and assists with other short courses.

9) Provides technical advisory services to country institutions for installation of in-country data base activities.

10) Supervises central data entry.

11) Maintains and updates data base.

12) Advises and supports, when necessary and appropriate, on data base development of other projects in CATIE.

13) Provides technical information and support for advisory teams for in-country activities.

14) Advises at least one student per year and serves as a member of the graduate committee for 2-3 more students per year.

15) Supervises and acts as an on-the-job trainer for the Data Base/Information Systems Technician.

16) Supervises and collaborates in the preparation of instructional materials in his/her field of expertise, especially training manuals and teaching modules for both the short-term training events and graduate courses.

17) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the visiting scholar fund, study tour fund or short-term non-degree fellowship program.

10. Data Base Management and Information Systems Technician

A. Qualifications: MS degree or equivalent in experience, in computer science and/or information management systems. Experience with data entry equipment and use of equipment; experience with use of canned statistical packages. At least 3 years experience in his/her field and reasonably bilingual.

B. Duties

1) Serves as the counterpart to the Data Base Management Specialist and assists him/her in conducting all technical tasks.

2) Aids the graduate students and special students in their thesis work or special studies in those aspects related to his/her field of expertise (computer software use).

3) Aids in the preparation of instructional materials related to the graduate courses and short-term training events in his/her field of expertise.

4) Aids in the carrying out of advisory services in the countries in his/her field of expertise.

5) Assists in the implementation of the graduate and short courses related to his field of expertise.

6) Assists in attending to professional and technical visitors with specific needs in his/her field.

7) Eventually replaces the Data Base Management Specialist (during the last year of the project).

11. Instructional Design and Materials Specialist

A. Qualifications

M.S. or Doctoral Degree (preferable) in education, or equivalent, with a second degree in natural sciences or in a technical area also highly desirable. Knowledge of the principles and applications of instructional design, preparation, production and evaluation. Experience in the design of instruction for audiences outside the formal classroom setting, such as university extension classes. Knowledge of public relations, public information and press relations. Experience in writing self-paced,

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programmed instruction. Experience and training in cross-cultural communications and/or education. Fluent in Spanish. Experience in Latin America preferable, but not essential.

B. Duties

1) Assists instructors to identify instructional needs.

2) Performs or assists others to perform the analyses necessary to prepare performance objectives and design instruction.

3) Locates and acquires existing instructional materials as appropriate.

4) Designs or modifies instructional methods and materials.

5) Sees to the preparation, editing, production and reproduction of instructional materials.

6) Establishes and maintains a system to deliver instructional materials to users and to see to the maintenance, repair and replacement of instructional materials and equipment.

7) Evaluates instruction and sees to necessary revisions.

8) Sees to the awareness and information services of the Project Information Office.

9) Provides advice and assistance to instructors and others on instructional materials and design.

10) Organizes, coordinates and teaches the technical short courses in Curriculum Development and Developing Instructional Materials Systems.

11) Plans, organizes and supervises special tailor-made study programs or parts of such in his/her field of expertise, for special students studying under the

visiting scholar fund, study tour fund or short-term non-degree fellowship program.

12) Provides advisory services to the countries in his/her field of expertise.

13) Serves on the graduate committees of at least 2-3 students per year.

14) Supervises and acts as an on-the-job trainer for the Instructional Design and Materials Technician.

12. Instructional Design and Materials Technician

A. Qualifications M.S. degree in education, or in a natural resources field with audiovisual and instructional material design experience. Technical writing and editorial expertise is highly desirable. Two years university level teaching experience and at least three years experience in his/her field. Reasonably bilingual.

B. Duties

1) Serves as the counterpart of the IDM Specialist and assists him/her in conducting all technical tasks.

2) Assists the IDM Specialist in the design preparation, evaluation and revision of instructional materials.

3) Assists graduate students in their thesis graphical contents and presentation.

4) Assists in the organization and implementation of the short courses related to his/her field of expertise.

5) Produces reports in answer to instructional design and materials requests and organizes their delivery.

6) Assists in attending to professional and technical visitors with specific needs in his/her field.

7) Aids in the carrying out of advisory services in the countries in his/her field of expertise.

8) Eventually replaces the IDM Specialist (during the last year of the project).

13. Country Coordinator

A. Qualifications M.S. or equivalent experience in some field of or related to watershed management. At least 2 years experience in Latin America with at least three years experience in watershed management projects and programs. Experience in coordination and/or administration activities. Teaching experience desirable. Fluent in Spanish and preferably Latin American, in which case must be bilingual.

B. Duties

1) Assists with the selection of prototype watershed projects (ongoing or otherwise).

2) Plans and implements the project activities in the coordinator's country.

3) Accounts for project budget-and funds for country.

4) Directs proper maintenance of all Project equipment in the country.

5) Reports on Project activities in the country.

6) Ensures the timely selection, nomination and clearance of country candidates for participating in out-of-country project activities.

7) Requests timely assistance from the Project Director's office to ensure that country program runs smoothly.

8) Serves as leader for on-job planning, application, and training on prototype watersheds.

9) Assists in development of technical guides, bulletins, manuals and land user oriented publications.

10) Assists with monitoring and evaluation of on-the-ground applications in the country.

11) Provides direction for country's data base operations, including information requests.

12) Identifies information, advisory and training needs and communicates them to Project Director.

13) Maintains a system for the distribution, circulation, and maintenance of institutional materials.

14) Helps to identify research areas within watershed management projects.

15) Helps in advising CATIE's graduate students who return to their home country to work on their thesis research projects.

16) Assists in the preparation of the short courses offered in the country as well as in their logistic support such as student selection, contacts with local institutions, arranges field visits, arranges hotel accomodations, etc.

17) Supervises the country secretary.

18) Works closely with a national counterpart trainee and team.

14. Consultants

It is expected that consultants will be needed to perform tasks related to advisory services and short course training in areas such as:

a) Erosion and Sedimentation
b) River Mechanics
c) Flood Control

d) Land Slide Rehabilitation
e) Environmental Sensing Methods
f) Environmental Impact Analysis
g) Project Planning, Evaluation and Analysis
h) Project Proposal Preparation
i) Technology Transfer Methodology
j) Environmental Education
k) Others, depending on specific needs detected by the project staff or the national institutions.

Specific job descriptions for these consultancies will be developed by project staff under the Project Manager's supervision, once the needs are more specifically identified.

AID INPUTS BY CURRENCY UTILIZATION
(U.S.$000)

	Foreign Exchange	Local Currency	Total
Personnel Costs	1,763.0	412.0	2,175.0
Training	712.0	443.0	1,155.0
Travel and Per Diem	305.0	--	305.0
Equipment	371.5	42.5	414.0
Other Costs	443.0	487.0	930.0
Overhead	--	732.0	732.0
Contingency	182.0	107.0	289.0
Totals	3,776.5	2,223.5	6,000.0

REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE
DETAILED PROJECTED BUDGET - RCCAP CONTRIBUTION
FOR THE PERIOD JANUARY 1, 1984 - DECEMBER 31, 1988

	TOTAL		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5	
	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT
Watershed Management Specialist	60	319,400	12	61,400	12	60,300	12	56,500	12	66,400	12	74,800
Natural Resources Economist	24	116,700	—	—	6	32,400	12	48,600	6	35,700	—	—
Soil and Water Conservation Specialist	48	225,300	—	—	12	55,600	12	54,400	12	51,000	12	64,300
Data Base Specialist	39	296,900	3	26,500	12	80,500	12	92,600	12	97,300	—	—
Instructional Material Specialist	42	316,600	6	46,200	12	80,500	12	92,600	12	97,300	—	—
Int's Professionals (110)	213	1,274,900	21	134,100	54	309,300	60	344,700	54	347,700	24	139,100
National Research Assistants	168	166,800	—	—	36	30,000	36	33,000	48	49,400	48	54,400
Administrative Assistant	60	59,800	12	9,800	12	10,800	12	11,800	12	13,000	12	14,400
Country Coordinators	204	407,100	—	—	36	66,000	48	92,400	60	121,300	60	127,400
National Professionals (120)	432	633,700	12	9,800	84	106,800	96	137,200	120	183,700	120	196,200
Short Term Consultants (160)	12	81,100	1	6,000	2	12,600	3	19,800	3	20,800	3	21,900
Temporary Personnel (170)	75	25,000	6	1,600	18	5,300	18	5,800	18	6,400	15	5,900
Administrative Support		160,400		8,200		22,700		36,200		45,000		48,300
Personnel Costs	732	2,175,100	40	159,700	158	456,700	177	543,700	195	603,600	162	411,400

REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE
DETAILED PROJECTED BUDGET - ROCAP CONTRIBUTION
FOR THE PERIOD JANUARY 1, 1984 - DECEMBER 31, 1988

	TOTAL		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5	
	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT
2 Masters (US)	—	100,000	—	—	—	12,500	—	37,500	—	37,500	—	12,500
14 Masters (CATIE)	—	266,000	—	—	—	38,000	—	85,500	—	95,000	—	47,500
Total Masters Degrees (210)	—	366,000	—	—	—	50,500	—	123,000	—	132,500	—	60,000
Short Courses (220)	—	376,000	—	—	—	62,000	—	115,000	—	110,000	—	89,000
Short Term Scholarships (230)	—	150,000	—	12,500	—	25,000	—	37,500	—	37,500	—	37,500
Visiting Scholar Fund (230)	—	24,000	—	2,400	—	4,800	—	6,000	—	6,000	—	4,800
Study Tours (230)	—	54,000	—	6,000	—	9,000	—	12,000	—	15,000	—	12,000
Workshops and Seminars (240)	—	185,000	—	18,000	—	23,000	—	24,000	—	50,000	—	70,000
Training	—	1,155,000	—	38,900	—	174,300	—	317,500	—	351,000	—	273,300
Travel and per diem (300)	—	305,100	—	25,700	—	47,300	—	88,000	—	89,900	—	54,200
Office Equipment (410)	—	37,500	—	17,500	—	18,000	—	1,000	—	1,000	—	—
Laboratory Equipment (420-450)*	—	75,000	—	40,000	—	35,000	—	—	—	—	—	—
Computer Equipment (420)	—	193,500	—	64,500	—	129,000	—	—	—	—	—	—
Vehicles (CATIE) (440)	—	20,000	—	20,000	—	—	—	—	—	—	—	—
Vehicles (Countries (440)	—	50,000	—	30,000	—	10,000	—	10,000	—	—	—	—
Tools (470)	—	5,000	—	2,000	—	3,000	—	—	—	—	—	—
Audiovisual Equipment (490)	—	33,000	—	11,000	—	22,000	—	—	—	—	—	—
Equipment	—	414,000	—	185,000	—	217,000	—	11,000	—	1,000	—	—

*(Includes installation costs)

REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE
DETAILED PROJECTED BUDGET - ROCAP CONTRIBUTION
FOR THE PERIOD JANUARY 1, 1984 - DECEMBER 31, 1988

	TOTAL		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5	
	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT
Printing and Reproduction (520-540)	—	40,000	—	4,000	—	8,000	—	10,000	—	10,000	—	8,000
" " "(Countries)(520-540)	—	17,000	—	—	—	3,000	—	4,000	—	5,000	—	5,000
Instructional Design Materials (540)	—	150,000	—	15,000	—	25,000	—	40,000	—	40,000	—	30,000
Materials for Audiovisual (560) (Cassettes, tapes, films)	—	4,000	—	500	—	1,000	—	1,000	—	1,000	—	500
Equipment Maintenance and Operation(620)	—	10,000	—	1,000	—	1,500	—	2,000	—	2,500	—	3,000
Laboratory Inputs (710)	—	6,000	—	500	—	1,000	—	1,500	—	1,500	—	1,500
Field Research Inputs (720)	—	10,000	—	1,000	—	1,500	—	2,500	—	2,500	—	2,500
Books and Periodicals (730)	—	20,000	—	4,000	—	7,000	—	3,000	—	3,000	—	3,000
Data Processing (740)	—	50,000	—	4,000	—	11,000	—	13,000	—	12,000	—	10,000
Flying and Aerial Photography (790)	—	20,000	—	2,000	—	4,000	—	5,000	—	5,000	—	4,000
Administrative Support		216,700		62,000		30,300		38,400		43,500		42,500
		543,700		94,000		93,300		120,400		126,000		110,000

REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE
DETAILED PROJECTED BUDGET - ROCAP CONTRIBUTION
FOR THE PERIOD JANUARY 1, 1984 - DECEMBER 31, 1988

	TOTAL		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5	
	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT	PM	AMOUNT
Technical and Professional Services(930)	—	10,000	—	500	—	2,000	—	2,500	—	2,500	—	2,500
Evaluations (930)	—	100,000	—	—	—	—	—	40,000	—	—	—	60,000
Field Support Costs (970)	—	240,000	—	-.-	—	42,000	—	58,000	—	70,000	—	70,000
National Training Support (970)	—	36,000	—	—	—	3,000	—	12,000	—	13,500	—	7,500
	—	386,000	—	500	—	47,000	—	112,500	—	86,000	—	140,000
TOTAL COSTS	—	4,978,900	—	503,800	—	1,035,600	—	1,193,100	—	1,257,500	—	988,900
Overhead (15% of total costs excluding evaluation)	—	731,800	—	75,600	—	155,300	—	173,000	—	188,600	—	139,300
Total	—	5,710,700	—	579,400	—	1,190,900	—	1,366,100	—	1,446,100	—	1,128,200
Contingency	—	289,300	—	29,400	—	60,300	—	69,200	—	73,300	—	57,100
TOTAL PROJECT COSTS	732	6,000,000	40	608,800	158	1,251,200	177	1,435,300	195	1,519,400	162	1,185,300

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REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE

ESTIMATED CATIE CONTRIBUTION

(US $000)

	BUDGET LINE ITEMS	TOTAL PM	TOTAL AMOUNT	DIRECT PM	DIRECT AMOUNT	INDIRECT PM	INDIRECT AMOUNT
PhD	Land Use Specialist	45	207.0	45	207.0		
PhD	Hydrologist	48	220.8	40	184.0	8	36.8
DSc	Natural Resources/Wildland Planning and Management Specialist (Head of Wildland and Watershed Program).	10	46.0	10	46.0		
PhD	Head of Renewable Nat. Resources Dept. and Agroforestry Specialist	5	27.2	5	27.2		
	Other						
PhD & M.S.	Other Natural Resources Specialists						
	a. Natural Forests Mgt.	8	36.8	6	27.6	2	9.2
	b. Forestry Management and Production/Silviculture/Reforestation	10	46.0	6	27.6	4	18.4
	c. Soils/Forest Soils	4	18.4	4	18.4		
	d. Agroforestry/Agro-Silvo Pastoral Systems	6	27.6			6	27.6
	e. Fuelwood Production	5	23.0			5	23.0
	f. Information and Communications	4	18.4			4	18.4
PhD & M.S.	Specialist from Other CATIE Departments/Units						
	a. Pasture Management and Agro-Silvo Pastoral Systems	6	27.6	4	18.4	2	9.2
	b. Soils	4	18.4	4	18.4		
	c. Agroecosystems	6	27.6	3	13.8	3	13.8
	d. Data Management Systems/Experimental Design/Statistics	5	23.0	5	23.0		
	e. Training/Information/Communications	8	36.8			8	36.8
	Subtotal International Professionals (110)	174	804.6	132	611.4	42	193.2

BUDGET LINE ITEMS	TOTAL PM	TOTAL AMOUNT	DIRECT PM	DIRECT AMOUNT	INDIRECT PM	INDIRECT AMOUNT
M.S.B.S. and/or Ing. National Professional Personnel:						
a. Chief, Tech. Asst. for Hydrologist and Soil/ Water Conservation Specialist	60	59.4	51	50.5	9	8.9
b. Other Tech. Asst. for Int. Prof. Staff	30	29.7	20	19.8	10	9.9
c. Information and Communication	8	6.7			8	6.7
d. Public Relations Officer/Journalist (1/2 time)	21	17.6	21	17.6		
e. Graduate School Director and Support Staff	4	4.0	4	4.0		
f. Graduate Students (Research & Training Support)	18	9.0			18.	9.0
Subtotal National Professionals (120)	141	126.4	96	91.9	45	34.5
Data Entry Spec./Keypuncher	48	16.3	48	16.3		
Draftsperson	48	16.3	48	16.3		
Secretaries	42	14.3	30	10.2	12	4.1
Field Assistants	10	2.8	5	1.4	5	1.4
Laborers	20	2.8	10	1.4	10	1.4
Subtotal Non-Professionals (130, 140 and 150)	168	52.5	141	45.6	27	6.9
TOTAL PERSONNEL (100)	483	983.5	369	748.9	114	234.6
Graduate Student Scholarships		104.5				104.5
Short Courses		45.0				45.0
Seminars and Workshops		40.0				40.0
TOTAL TRAINING (200)		189.5				189.5

BUDGET LINE ITEMS	TOTAL PM	TOTAL AMOUNT	DIRECT PM	DIRECT AMOUNT	INDIRECT PM	INDIRECT AMOUNT
International Travel		15.0		1.0		14.0
Regional Travel		15.0		1.0		14.0
Local Travel		3.0		2.0		1.0
TOTAL TRAVEL (300)		33.0		4.0		29.0
Office Space and Equipment		79.6		79.6		
Laboratory and Teaching Space		34.8		34.8		
Laboratory and Research Equipment		56.0		10.0		46.0
Field Equipment		5.0		5.0		
Audiovisual Equipment		3.0		3.0		
Vehicles		20.0				20.0
TOTAL EQUIPMENT (400)		198.4		132.4		66.0
Communications: Photocopying, printing and reproduction of educational materials, telephone, telex, etc. (500)		10.0		2.0		8.0
Maintenance and Operations of Vehicles and Other Equipment (600)		25.0		10.0		15.0
Laboratory, Research and Teaching Supplies and Inputs (700)		10.0		2.0		8.0
General Expenses (900)		10.0		5.0		5.0
Total Others		55.0		19.0		36.0
GRAND TOTAL	483	1,459.4	369	904.3	114	555.1

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REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE

ESTIMATED COUNTRY CONTRIBUTIONS (US$000)

Budget Line Item	PM	AMOUNT
Host Country Counterpart/Asst. Country Coordinators (full-time)	204	122.4
Other Professional Counterparts from Country Resource Management Agencies and Universities (1/4 time, avg.4/country)	190	114.0
Draft persons, cartographers, photo interpreters	190	57.0
Field Assistants	190	47.5
Secretaries	100	25.0
Laborers	380	57.0
Subtotal Personnel	1254	422.9
Graduate Student Scholarships (10.5)	—	199.5
Short Courses, Workshops, Seminars	—	100.0
Salaries and Benefits for Graduate Students while in Training (M.S. Program)	—	439.2
Subtotal Training	—	738.7
Local Travel	—	40.8
Subtotal Travel	—	40.8
Office Space and Equipment	—	25.4
Laboratory Space and Equipment	—	5.0
Teaching Space and Equipment	—	7.5
Field Equipment	—	7.5
Audiovisual Equipment	—	5.0
Vehicles	—	25.0
Data Base Equipment	—	25.0
Subtotal Equipment	—	100.4
Communications: Office Supplies, Telecommunications, Photocopying, Publications, Printing	—	18.7
Maintenance and Operation of Vehicles and Other Equipment	—	30.6
Date Processing	—	25.0
Laboratory, Teaching and Research Supplies	—	8.5
General Expenses	—	10.0
	—	92.8
GRAND TOTAL	1254	1,395.6

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CATIE

STATEMENT OF ASSETS, LIABILITIES AND GENERAL WORKING FUND

AS OF DECEMBER 31, 1979, 1980, 1981 AND 1982

(US $000)

	1979	1980	1981	1982 1/
ASSETS				
Cash and Banks	193	379	799	432
Investments	—	—	135	503
Accounts Receivable	1,298 2/	401	463	500
Inventories	162	195	247	172
Prepaid Expenses	152	19	1	—
Special Funds (Covenants & Contracts)	—	694	272	238
Other Assets	327	—	—	—
TOTAL ASSETS	2,132	1,688	1,917	1,845
LIABILITIES AND GEN. WRKG. FUND				
Loans Payable	88	390	—	—
Accounts and Other Expenses Payable	967	1,149	849	127
Provisions	369	558	672	890
Special Funds (Covenants & Contracts)	816	653	771	673
	2,240	2,750	2,292	1690
General Working Fund (Deficit)	(108)	(1,062)	(375)	155
TOTAL LIABILITIES AND GENERAL WORKING FUND	2,132	1,688	1,917	1,845

1/ Unaudited figures.
2/ Includes special funds.

FA:MCalderon/rl
05-12-83 (0944r)

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CATIE

COMPARATIVE CONSOLIDATED INCOME AND EXPENDITURES

FOR THE PERIODS ENDING

DECEMBER 31, 1979, 1980, 1981 AND 1982

(US $000)

	1979	1980	1981	1982 1/
INCOME				
Basic Activity Budget	2,633	2,992	2,872	2,651
Special Funds (Covenants)	2,314	4,996	4,467	5,488
TOTAL INCOME	4,947	7,988	7,339	8,139
EXPENSES				
Basic Activity Budget	2,446	3,883	2,185	2,121
Special Funds (Covenants)	2,668	4,996	4,467	5,488
	5,114	8,879	6,652	7,609
Excess (Deficit) Income Over Expenses	(167)	(891)	687	530
Beginning of Year (Deficit) Surplus	59	(108)	(1,062)	(375)
Auditors' Adjustment	—	(63)	—	—
End of Year Surplus (Deficit)	(108)	(1,062)	(375)	155

1/ Unaudited figures.

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05-12-83 (0944r)

CATIE

DETAILED INCOME AND EXPENDITURE STATEMENT

FOR THE PERIODS ENDING DECEMBER 31, 1979, 1980, 1981 AND 1982

(US $000)

	1979	1980	1981	1982 1/
INCOME				
Member Quotas	765	844	923	990
Services & Assets Administration	1,603	712	754	550
Covenants & Contracts Adm.	236	709	708	655
Special Funds for Covenants & Contr.	2,314	4,996	4,467	5,488
Currency Fluctuations	—	415	142	—
Donations	—	—	64	—
Other Income	29	312	281	456
	4,947	7,988	7,339	8,139
OTHER COSTS AND EXPENSES				
General Direction	112	160	181	153
Technical Programs and Coordination	1,012	1,389	783	931
Support & Adm. Expenses	796	1,146	662	416
Substructure Expenses	—	—	—	132
Field Operations	460	433	241	179
Special Funds Programs	2,668	4,996	4,467	5,488
General Expenses	66	533	198	282
Financial Expenses	—	98	120	—
Asset Replacement	—	124	—	—
Currency Fluctuations	—	—	—	28
	5,114	8,879	6,652	7,609
Excess (Deficit) of Income Over Exp.	(167)	(891)	687	530

1/ Unaudited figures.

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CATIE

STATUS OF MEMBER QUOTAS COLLECTED

AS OF DECEMBER 31, 1980, 1981 AND 1982

(US $000)

	1980	1981	1982
IICA	641	673	740
Costa Rica	62	—	50
Guatemala	—	—	50
Honduras	50	50	50
Panama	100	50	50
Nicaragua	—	—	50
	853	773	990

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05-12-83 (0944r)

C A T I E

BASIC ACTIVITIES & SPECIAL FUNDS BUDGET

AS OF DECEMBER 31, 1982 AND 1983

(US $000)

	1 9 8 2			1 9 8 3		
	BASIC ACTIVITIES	SPECIAL FUNDS	TOTAL	BASIC ACTIVITIES	SPECIAL FUNDS	TOTAL
INCOME						
Board of Directors-Office of the Director	1,309	—	1,309	1,476	—	1,476
Annual Crops & Perennial Plants Program	945	3,733	4,678	479	3,156	3,635
Animal Production Program	243	1,470	1,713	173	1,081	1,254
Natural Renewable Resources Program	294	1,957	2,251	262	1,596	1,858
Research & Teaching Development Program	191	1,993	2,184	553	706	1,259
Other Income	—	—	—	—	810	810
	2,982	9,153	12,135	2,943	7,349	10,292
EXPENSES						
Board of Directors - Office of the Director	170	—	170	118	—	118
Administrative & Financial Operations	1,156	—	1,156	641	—	641
Annual Crops & Perennial Plants Program	707	3,237	3,944	549	3,156	3,705
Animal Production Program	350	1,470	1,820	398	1,081	1,479
Natural Renewable Resources Program	238	1,957	2,195	299	1,596	1,895
Research & Teaching Dev. Program	288	1,993	2,281	637	706	1,343
Planning Department	—	—	—	300	—	300
	2,909	8,657	11,566	2,942	6,539	9,481

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05-12-83 (0944r)

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ROCAP CONTRIBUTION

CATIE - Explanation of Budget Items

1. International Professional Staff

Three of the five professionals recruited internationally for long-term service in the project will be paid in accordance with CATIE rules and regulations which are, ultimately, those of the United Nations system as adopted by the Organization of American States and the Instituto Interamericano de Cooperacion para la Agricultura (IICA), which provides core budget support to CATIE. Personnel salaries were based on the salary scale as of June 1983. In addition to the basic salary, the indicated annual gross salaries include the following benefits: family, education and housing allowances; insurance coverage; pension retirement fund and post differential. Additionally, recruitment and repatriation, transportation of personal effects and installation benefits were calculated at the beginning and at the end of the contract, and were estimated as 20% of the annual gross salary. A home leave benefit, given every two years, was computed as 12% of the annual gross salary. A 5% annual gross salary increase was calculated throughout the project period. The actual salaries will be negotiated, following the CATIE rules and regulations.

The remaining two professionals' salaries (Data Base and Instructional Materials Specialists) were calculated on adjusted PASA rates, to follow more closely CATIE's regulations on housing and educational allowances. The actual PASA salaries and benefits will be negotiated before the signature of the Grant Agreement. A 5% annual gross salary increase was calculated also for these positions.

2. National Professional Staff

a. Country Coordinators

An approximate figure of $22,000 for gross annual salary including all social and other benefits and similar additional costs (recruitment, repatriation, home leave, etc.) was used to calculate the costs for those five positions. It is a weighed

*e.g.,the AID/ROCAP - supported and CATIE - executed Small Farm Production Systems Project (No.596-0083) and Fuelwood and Alternative Energy Sources Project (No.596-0089).

average figure assuming that 3-4 country coordinators would be international professionals and 1-2 national professionals. It is somewhat low for what the first type in reality would cost and high for the latter, when all costs (salary, benefits, etc.) are included. Also, a 5% annual gross salary increase was calculated throughout the project period.

If, in practice, it is possible to recruit more national professionals for these positions, then any savings will be returned to the contingency budget line item. If the reverse were to occur, any extra funds needed would be drawn from contingency funds.

b. Other National Professionals

The following annual salary rates were used, in accordance with existing average rates for such CATIE personnel (Costa Rican national professionals). They include all social and similar benefits:

National Research/Professional Assistants (M.S. degree level):	$ 8750/year
Administrative Assistant:	9800/year

A 10% annual increase in cost was calculated for these positions, starting with the above rates, to cover inflation and normal salary increases.

3. Short-Term Consultants

A standard basic cost for a one-month consultancy (20 work days) was utilized, as follows:

Salary: $150/day x 20 days	$3,000
Perdiem: $50 avg./day x 30 days ($30 at CATIE, $75 average in countries)	1,500
Round Trip International Travel (air fare & related costs)	850
Regional Travel (air fare, ground transport and related costs)	350
Insurance	100
Miscellaneous Costs	200
TOTAL	$6,000

These are average costs, with the understanding that they would be higher (+ or - $8,500 - 9000/month) for PASA-type arrangements, while others would be much less (+ or - 2,500-4500), as in the case of bilateral special agreements with Latin American and/or U.S. universities and similar institutions, or through direct contact with high level professionals, all of with which CATIE has ample experience and a number of existing examples.

A 5% annual increase in costs was calculated over the life of the project for this item.

4. Temporary Personnel

This category includes personnel employed for short-term periods on personal contracts to carry out a variety of specific jobs, both in the five countries and at CATIE. It includes personnel for a very wide variety of short-term tasks such as photo-interpretation and cartography; illustrations and artistic design; construction and installation of watershed measurement and management infrastructure (wiers, hydrometeorological stations, runoff/erosion plots, terracing, reforestation and other physical/biological treatments); inventories, surveys or other special studies; etc. Thus, it will involve national personnel of various types: professionals, semi-professionals, field assistants, and laborers. Accordingly, an average figure of $333/month for such services was used, based on average existing costs in the five countries and at CATIE. The services will be mostly for a few weeks to a few months at a time, but never exceeding three months per contract. A 10% annual increase in costs was calculated to take into account inflation.

5. Training

a. Masters Degree in the U.S.

The currently utilized AID estimate of $25,000/person/year was used. That covers all costs.

b. Masters Degree at CATIE

Current costs are approximately $8,000 - $10,000/year/student, depending upon origin (travel costs vary) and the variable costs of support (materials, equipment, etc.) for thesis research. An average cost was calculated as follows, given that the program will extend over the five years and inflation will certainly occur. All costs are for two years for the full M.S. Degree Program:

International round trip travel, living stipend, books, tuition, thesis preparation and reproduction, insurance and social fees:	$17,000
Equipment, materials, supplies, travel and other costs for thesis research:	2,000
Total per student for 2-year scholarship, all costs:	$19,000

c. Technical Short Courses

1. Short Course Estimates (at CATIE)

(a) 1 Week: 20 participants (4 from Costa Rica require no international travel); avg. 4 Country Coordinators also attend, travel paid by course, perdiem covered otherwise.

Perdiem: 7 days x $30/day/person x 20 persons	4,200
International Travel: 20 persons x $350/person	7,000
Materials, supplies and Closing Session	500
Local, transport (bus)/Miscelaneous	300
Total	$12,000

(b) 2 Weeks: 20 participants (five Costa Ricans require no international travel); avg. 3 Country Coordinators also attend, travel paid by course, perdiem covered otherwise.

Perdiem: 13 days x $30/day/person x 20 persons	7,800
International Travel: 18 persons x $350/person	6,300
Materials and Closing Session	550
Local Transport (bus)/Miscelaneous	350
Total	$15,000

(c) 3 Weeks: 20 participants (five Costa Ricans require no international travel); avg. 3 Country Coordinators also attend, travel paid by course, perdiem covered otherwise.

Perdiem: 20 days x $30/day/person x 20 persons	12,000
International Travel: 18 persons x $350/person	6,300
Materials and Closing Session	900
Local Transport/Miscellaneous	800
Total	$20,000

2. Short Course Estimates (in member country)

(a) 1 week: 20 participants, 5 from member country need no international travel.

Perdiem: 7 days x $45/person/day x 23 persons	7250*
International Travel: 18 persons x $350/person	6300*
Materials and Closing Session	600
Others	850**
Total	$15000

*Includes total of 3 faculty/country coordinators from CATIE
**Others includes items such as field trips, bus rental, and contingency

(b) 2 weeks: 20 participants, 5 from member country

Perdiem: 13 days x $45/person/day/24 persons...14,040*

International Travel: 19 persons x $350/person...6,650*

Materials and Closing Session.....900

Others.....1,410

Total 23,000

*Includes 4 faculty/country coordinators from CATIE

(c) 3 weeks: 20 participants, 5 from member country

Perdiem: 20 days x $45/person/day/25 persons...22,500*

International Travel: 20 persons x $350/person...7,000*

Materials and Closing Session.....1,200

Others.....4,300**

Total $35,000

*Includes 5 faculty/country coordinators from CATIE
**The three-week courses are field-oriented and will involve extensive in-country travel (bus rental) possible rental of a meeting hall when held outside of the host institution and considerable other field expenses.

d. Short-term Scholarships for Post-graduate Study.

Cost for these is highly variable depending upon where they would be conducted, origin of the recipient (variable travel costs), etc. Costs range from averages of $1000/month at CATIE to $1,200-1800/month elsewhere in Latin America to $3,000-3500 in the U.S. An average of $2,500 a month was used including all costs: international travel, tuition, books, living stipend, etc.

e. Visiting Scholar Fund

These would be for study for up to six months at CATIE for new holders of degrees from foreign countries, for partial support for visiting professors, professionals, etc., from the region, and other special similar cases, to allow them to brush up on specific subjects via courses, in-service tailored study programs, etc. Only a basic living stipend and related basic costs would be covered, at an average of $600/month. International travel and other costs would be borne by outside funding sources.

f. Study Tours

These would average approximately 2-3 weeks in length and be tailored to the specific needs of each individual participant. Average cost would be $3,000 per study tour month including regional/international travel, perdiems and related minor costs.

g. Workshops and Seminars

In general, the calculations for these events were very similar as for the technical short courses, taking into account number of participants, where to be held (CATIE or member country) and length. Please refer to the technical short course calculations. In a few cases special comments are necessary:

1) Natural Resources Policy Seminar for Decision Makers. Given that these will be ministers, political leaders, university rectors and deans, etc., per diem costs were estimated at approximately $90/person/day, appropriate quality bus rental (for field visits) and hall rental were included, etc.

2) For the Central American Watershed Management Workshop, the $45,000 will cover the costs of all 65 participants including 45 CA/P country participants and 20 from the region's AID Missions, ROCAP and CATIE.

3) The Tropical Watershed Workshop will have worldwide representation. The $50,000 total estimate will cover basic workshop costs and the participation of 40 CA/P participants and 20 from the AID Missions, ROCAP and CATIE. The remaining 100 participants from the rest of the world will be financed by other sources, part of which the project staff will help identify and develop.

6. Travel and Perdiem

The following table gives the breakdown of this item.

REGIONAL TROPICAL WATERSHED MANAGEMENT PROJECT - CATIE

Detail of Travel and Perdiem

(US$)

	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Senior Professional Staff and Chief Technical Assistants (project staff) and the RNRD Staff: Regional travel	237,000	23,700	35,600	71,100	71,100	35,500
Collaborating CATIE Professional staff from other departments: regional travel	6,480	540	1,080	1,620	1,620	1,620
Country Coordinators: travel to CATIE	20,520	-	3,420	5,700	5,700	5,700
Country Coordinators: in country travel	30,600	-	5,400	7,200	9,000	9,000
CATIE Staff: in Costa Rica	10,500	1,500	1,800	2,400	2,400	2,400
	305,100	25,740	47,300	88,020	89,820	54,220

The following main considerations were taken into account in calculating travel and perdiem costs:

a) Of the project staff of 7 senior professionals and 5 chief research/technical assistants (national professionals), the Instruction Materials Design/Curriculum Development Specialist and the Data Base Management Specialist and their Assistants will travel in the region in a more limited manner than the other eight, who are expected to travel very extensively. Collaborating professional staff from the Renewable Natural Resources Department will make occasional trips each year to provide advisory services in the region. Thus, travel requirements were estimated in order to be able to provide all necessary advisory services and for design, planning, organizing and coordinating training activities with the country institutions and country coordinators, using an average expected travel figure and taking into account that most travel will occur in years 2-5.

b) Collaborating staff from other CATIE Departments will be expected to make an average of two trips per year in the region for advisory services.

c) Country Coordinators will be expected to visit CATIE 2-3 times per year in order to review progress of the entire project, for in-service training and coordination in general. Since the Costa Rica Country Coordinator will be stationed in San Jose and will frequently make day trips to CATIE as well as be in contact with the project staff on their frequent visits to San Jose, less trips and perdiem time were calculated for that individual than for the other Country Coordinators.

d) Country Coordinators will be expected to travel in country an average of 12 weeks per year (6 work day weeks) in relation to advisory services, prototype and ongoing projects and other activities.

e) Rather extensive travel in Costa Rica will be necessary by Project staff, graduate students, and collaborating professional staff of the RNRD and other CATIE departments, in relation to integrated management and research activities in the outdoor laboratory, advising of students, preparation and contracting of printing of educational materials in San Jose, and many other similar activities. This will mostly involve only day trips and thus perdiems will be low, only involving meals, parking costs, and similar minor expenses. On occasion hotel bills will be involved, but costs are low.

f) Cost for perdiem and travel for training events are not included here as those are covered under the training activities, except for perdiems for country coordinators while attending short-term training events at CATIE, which are included here, because visits to CATIE for coordination will be timed to coincide with training events as much as possible.

g) The perdiem averages used for calculations are based on existing averages. The average cost for travel includes average economy-class air fare in the region (round-trip to/from a country), ground transport Turrialba-San Jose airport-Turrialba (380 kms/trip), major taxis to/from airports in host countries, airport taxes, visa costs and similar minor expenses.

Based on the above considerations, the following calculations were made:

a) Senior Professional Staff Chief Technical Assistants and Collaborating RNRD Professional Staff: Regional Travel

Travel: 10 persons x 5 trips/person/year
x 4 years (avg.)x $360/trip.....72,000

Perdiem: 10 persons x 5 trips/person/year
x 11 days/trip x 4 years x $75/day.....165,000
Total $237,000

b) Collaborating Staff from Other CATIE Departments: Regional Travel

Travel: 2 persons x 1 trip/person/year
x 4 years (avg.)x $360/trip..... 2,880

Perdiem: 2 persons x 1 trip/person/year
x 6 days/trip x 4 years x $75/day.....3,600
Total $ 6,480

c) Country Coordinators: Travel to CATIE

Travel (excluding Costa Rica Country Coordinator)
13 person-years x 3 trips/person/year
x $360/trip.....14,040

Perdiem:

(1) Non-Costa Rica Country Coordinators:
13 person-years x 3 trips/person/year
x 5 days/trip x $30/day.....5,850

(2) Costa Rica Country Coordinator:
4 person years x 2 trips/person/
year x 2.6 days/trip x $30/day.....630
Total.....$20,520

d) Country Coordinators: in-Country Travel

Perdiem:

17 person-years x 72 days/person/year
x $25/day.....30,600
Total.....$30,600

e) CATIE Staff: travel in Costa Rica

10 persons (avg.) x 20 days (avg.)
travel/year/person x 5 years x $10.50
day (avg).....10,500
Total.....$10,500

7. Commodities (Equipment)

a) Vehicles

A total of seven utility vehicles, six 4-wheel drive ones and one diesel utility sedan, will be purchased during the life of the project. Five of the 4-wheel drive ones will be for the Country Coordinators' operations and the other two for the CATIE Project Staff at Turrialba. Estimated delivered cost, tax exempt, of such vehicles to Costa Rica is $10,000 per unit.

b) Office Furniture and Equipment

The standard cost of $2,500 per office unit was applied. This includes one desk, one chair, one filing cabinet, one small calculator for the professional/technician, plus one third of furniture costs and one electric typewriter for secretarial support (one secretary for each three professional/technical staff). Thus a total of ten units was calculated for CATIE, plus one unit for each of the five Country Coordinators. In the case of the Country Coordinators the $2,500 per unit includes furniture and a manual typewriter for secretarial support (one secretary per country coordinator unit).

c) Laboratory Equipment

This item includes most equipment, plus some installation costs, to establish the outdoor teaching - research - management laboratory in the Rio Tuis watershed near CATIE. It includes a wide variety of equipment such as wiers, hydrological and meteorological instruments, run-off and erosion collecting installations, etc. CATIE and other donors will cover part of these equipment needs. (See the next section in this annex).

d) Computer/Data Base Equipment

The equipment which must be added to the existing computer center at CATIE, and which will mesh properly with it, in order to make this project functional, is as follows:

Item	Cost
IBM 3370 Disk, 570 MBytes Capacity	45,000
IBM 8809 Tape drive, 20-120 KBS	13,500
IBM 3262 Printer, 600 Ppm	18,500
Plotter	15,000
4 terminals	12,000
Data Entry Station	6,500
3277 Terminal, Graphic Attachment (to run plotter)	8,000
*3274 Control Unit (32 terminals)	25,000
*Increased processor capacity, 2 MBytes	50,000
Total	$193,500**

*To run disk, tape, printer, plotter and terminal
**Puchase period:

1984	Second half	64,500
1985		129,000
	Total	$193,500

CATIE will purchase a digitizer at an approximate cost of $15,000 with currently available funds (see next section this annex), in order to complete this system.

All prices include delivery to Costa Rica, tax exempt.

e) Audiovisual Equipment

This item includes the instructional design and materials equipment necessary for the project, both at CATIE and in the countries. All prices are estimated as delivered to Costa Rica, tax exempt. The equipment is as follows:

Quantity	Description	Approximate Cost
1	Multilith machine	$11,200
7	Lectern-Type public address systems @ $400	2,800
8	Film Strip projectors @ $180	1,400
8	Slide Projectors @ $250 (w/zoom lenses)	2,000
7	Projection screens @ $160	1,120
7	Synchronized tape playback tape recorders @ $500	3,500
7	35 mm cameras w/35mm or 50 mm lenses @ $300	2,100
2	5 Drawer vertical files w/heating elements @ $150	300
200	Saf-T-Stor or equivalent slide protectors, hanging @ $45/25	400
250	Slide carousels @ $5	1,200
4	Flat work file drawers @ $30	120
1	Complete drafting station	1,000
7	16 mm. motion picture projectors	5,000
7	Projection stands (safe-loc type or equiv.)	860
	Total	$33,000*

Purchase Period:

1984: second half	11,000
1985	22,000

8. Materials and Supplies

Approximate costs of instructional design materials, audio-visual materials and other printing and reproduction were calculated as follows:

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Quantity	Description	Approximate Cost
12,000	Reading syllabi, workbooks and field/laboratory exercise manuals for short courses and workshops/seminars (on various subjects): approximately 10 different of each type x 3 types x 400 copies of each avg. x avg. cost of $5/copy.	$60,000
2,000	Teacher's Manuals for short courses and workshops/seminars: Approx. 10 different ones x 200 copies avg. x avg. cost $3/copy.	6,000
400	Instruction design and materials handbook for instructors and teachers: 400 copies x $5/copy.	2,000
4,500	Reading syllabi, workbooks and field/laboratory exercise manuals for graduate courses: Approx. 10 of each type x 3 types x 150 copies each avg. x avg. cost $5/copy	22,500
700	Teacher's manuals for graduate courses: Approx. 10 different ones x 70 copies avg. x avg. cost $3.85/copy	2,700
4,800	Technical manuals for advisory services on a variety of watershed management topics and practices (e.g. integrated management planning methodologies, soil and water conservation practices, etc.): 8 different manuals x 600 copies of each x avg. cost $4/copy.	19,200

Quantity	Description	Approximate Cost
400	Prototype watershed management instructional packages (reading syllabi, field/laboratory manuals, teacher's manuals, etc.) for undergraduate and technical training institutions: 2 types x 200 copies of each x $20/copy.	$ 8,000
50	Prototype/experimental self-paced (home study) programmed instructional package (texts), to be tried in one country: 50 sets x $80/set	4,000
320	Slide-tape programs and film stips: 8 different ones of each type x 2 types x 20 copies of each x $50 avg. per copy.	16,000
9,600	Newsletter: 3 issues/year x 4 years x 800 copies/issue avg. x $1/copy.	9,600
11,750	Materials for preparation, printing and reproduction of other project publications including progress reports, annual reports, and other teaching and advisory services materials to be determined, both at CATIE and in countries: approx. 47 different items x 250 copies per item average x $4/copy avg.	47,000
Variable	Cassettes, reel-to-reel tapes, 35 mm. slide film and developing and 16 mm. films.	4,000
	Total	$ 201,000

The costs indicated include materials and supplies needed for office/laboratory work to prepare instructional materials to the production script/mock-up/photocopy stage and for contracting the actual printing. Likewise, slide-tape programs and film strips costs include production through the mock-up stage at CATIE with final production being contracted outside. Some of the simpler publications and teaching materials will be mimeographed and multilithed at CATIE.

In the case of virtually all instructional materials and publications the number of copies to be produced will cover not only the needs of all participants and CATIE instructors and staff for short courses, workshops, seminars and the graduate program, but also include sufficient copies to distribute each publication widely in sizeable numbers (20-50 depending on the type) to appropriate resource management, educational and

similar institutions in all five countries and for distribution of a small number of copies to AID/Washington, ROCAP, AID Missions in the region, other key bilateral and international agencies and select national agencies in other Latin American countries.

9. Laboratory, Research and Similar Inputs, Supplies and Services

a) Laboratory and Field Research Inputs

These will cover materials and supplies (expendables) for the outdoor teaching - research - management laboratory, laboratory materials such as soil and water sample testing supplies, etc.

b) Books and Periodicals

This will cover acquisition of technical and scientific books and key watershed management journals and related professional publications. It is expected that by the end of the project CATIE will have the most complete and advanced documentation center/library in tropical watershed management in the entire Western Hemisphere or at least the entire Latin America - Caribbean area, as it now has in many other areas of tropical natural resources management and agriculture, e.g. agroforestry, wildlands management, wildlife management, tropical forestry management, etc.

c) Data Processing

This item will cover computer access time.

d) Flying and Aerial Photography

These funds are to cover costs of aerial photography and reconnaissance overflights of key watershed areas in relation to prototype and ongoing projects linkages and other types of advisory services in the countries. The amount is small, but should be adequate as almost all services will be obtained at cost or less from the national geographic and mapping agencies and/or air forces, i.e., for only fuel and film costs. CATIE, particularly the Wildlands and Watershed Program, has been extremely successful in the past in virtually always obtaining such services through its national institutional contacts.

10. Other Costs

a) Technical and Professional Services

These funds will be for specific services contracted on an item or "finished product" basis rather than for time. It will include services in both the countries and at CATIE and will include ones such as map production; photo-interpretation; legal services for contracts; agreements, etc.; etc.

b) Field Support Costs

An amount of $12,000/year/country would be available for equipment, supplies, special studies and many other possible similar items and activities, in order to be able to effectively and efficiently link into ongoing projects or catalyze the starting of new prototype projects or new aspects of existing projects, as most appropriate in each country. Likewise, the funds would aid in strengthening other advisory services activities. In essence, the funds would serve as small amounts of "seed money" to insure that CATIE's involvement were effective and efficient and to stimulate major financial, human resources and other commitments from the country institutions and other donors. The Wildlands and Watershed Program has been demonstrating for over six years that this approach is very effective and produces major results in terms of country commitments of personnel and funds to key well-selected projects, as well as considerable outside donor participation (both financial and technical inputs). The definition of the kind, type and quantity of equipment, supplies, activities, etc. would be defined when the projects are carefully identified in the field by the Country Coordinators and the professional CATIE staff, in conjunction with national counterpart institutions.

The funds for special studies of international watersheds would serve, like those under the previous item, as seed monies to enable initiating key resources reconnaissances, inventories, management planning exercises and other similar studies and activities in major watersheds which are shared by two or more countries, with bi-or multinational teams from the countries as main executors. The CATIE professional staff and Country Coordinators would serve as chief technical advisors to stimulate and guide these initial activities, including aiding the countries in preparing plans and proposals to obtain additional national, international and bilateral technical and financial support based on the results of the initial studies and activities.

The CATIE Wildlands and Watershed Program has provided just this sort of technical assistance and seed money with excellent results in the case of a few international wildland areas in the region, e.g. Rio Platano, the La Amistad-Talamanca Range Biosphere Reserve and International Park in Panama and Costa Rica.

c) National Training Support

These funds would be to provide equipment, supplies and other support in the countries for the short courses to be held there jointly with CATIE, as part of this project. They would also be used to stimulate and catalyze the planning, organization and conducting of additional country-level training events as spin-offs from this project, with major responsibility and funding being provided by the country agencies and other donors. The CATIE Wildlands and Watershed Program has very successfully stimulated such training spin-offs in the wildlands field over the past few years as part of its regional technical assistance and training program.

11. Overhead

An "overhead" of 24.6 percent was used to estimate administrative support costs. The rate is applied to all line items except "evaluation", which will take place independently of CATIE.

CASES OF WATERSHED DEGRADATION AND RESULTANT IMPACTS FOR THE CA/P REGION

Country	Location	Nature of Problem	Consequences
Panama	Panama Canal Watershed	Between 1952 and 1978 forest cover declined from 83% of total land area to only 32% because of spontaneous colonization.	Sedimentation rates in Lake Alajuela have increased by more than 200% in recent years. By the year 2020 80% of the storage capacity of the Lake will be lost to sedimentation if present rates persis (if not sooner with greater deforestation).
	Countrywide	Only 50% of Panama remains under native forest. The annual rate of deforestation is estimated at 36,000 has.	Accelerated erosion rates are observable in many parts of the country. One extreme case is in Boquete and Cerro Punta, Chiriqui where erosion rates have been recorded at 1600 to 2000 metrc tons/ha/yr.
	Azuero Peninsula (Especially towns of Penonome & Aguadulce)	Extensive deforestation, annual burning and overgrazing of uplands.	Dropping well, spring and stream levels and persisting drought conditions. Initiation of true desertification effects.
	Pacific Lowlands & Central Provinces	Inappropriate or abusive uses of land including annual burning.	Loss of soil to the point that many areas are completely non-productive or wastelands. Critical shortages of fuelwood.
	Rio Caldera	70% of upper watershed has been cleared.	Severe floods and torrential conditions have caused considerable property damages and loss of life.
	Tonosi, Oria, Guarare, La Villa, Parita & Escota Rivers	Watershed deterioration has led to reduced dry season flows.	Water quality has been seriously degraded partly because of reduced dilution factor. Human health problems have resulted.
Costa Rica	Country Wide	Between 1950 and 1977 dense tropical forests decreased by 41%. Forest clearing continues at a rate of approximately 65,000 hectares per year.	Loss of wildlife habitat and general degradation of watershed quality

	Coastal Zones of Nicoya Peninsula and Vicinity	Extensive deforestation burning and overgrazing of upland watersheds. The lowering of water tables due to the decreased recharge potential of upland watersheds.	The lowering of water tables and dry season loss of water supply for coastal beach communities of Tamarinrindo, el Coco, Cahuita, and Puntarenas. Salt water incursions of aquifiers in coastal zone.
	Rio Sombrero Parrita, Tuis and other watersheds	Flooding and landslides have greatly increased in frequency and magnitude over the last 30 years.	Serious losses in crops, infrastructure housing and life.
	Rio Reventazon	Largely due to degradation in one tributary stream of the Cachi Reservoir (12 yrs old) accelerated siltation has occurred.	Over 40% of the useful storage of the reservoir has been lost.
Nicaragua	Country Wide	Only 32% of the total land surface in Nicaragua remains under dense tropical forest. Deforestation rates (for all types of forests)are estimated at 90,000 has/yr.	Wildlife habitat is lost directly and several cases have been documented of changed watershed morphology.
	Lake Managua	Improper land use and an almost complete lack of environmental protection practices is causing accelerated sedimentation and the dumping of fertilizer residues, pesticides and untreated sewage effluents.	Lake waters for the most part are useless and/or a health hazzard because of high salts, organics and chemical levels of contaminants.
	Pacific Lowlands around Leon	The total clearing of vegetative cover in the cotton growing areas has created an eolic erosion problem so serious that nearby Leon is plagued by "dust bowl" type dust storms.	Health and infrastructure problems.
	Chinandega	Almost complete devegetation of the upper watersheds.	In May 1982, flood impacts were substantially exacerbated by the watershed condition and losses amounted to an estimated 200+ million dollars in damages, 100+killed and 700 homeless.

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Honduras	Sula Valley	Improper land use especially deforestation of protection forests on steep uplands followed by annual burning, overgrazing and/or slash and burn agriculture.	Flooding in the Sula Valley (drainage of the Ulua and Chamelco rivers) causes an estimated 33.5 million dollars in flood damage annualy to agriculture and infrastructure over a geographic area of 370 sq.km. Floods resulting from the heavy rains of Hurricane Fifi in 1974 were the worst on record although much of the damage is attributed to improper land use. Damages: approximately 12,000 killed, primarily in the Sierra de Omoa area;$150 million damages in the Sula Valley; flooding of nearly 470 sq. kilometers in the Choluteca river valley.
	Aguan River Valley	Improper land use.	RENARE estimates that the value lost to erosion and loss of soils and flooding in the Aguan River and Atlantic littoral watersheds is in excess of $4.5 million per year, a figure which is considered very low because it does not include all watersheds.
	Choluteca River Valley	Improper land use.	Annual flooding estimates an estimated 3400 hectares of prime farm- and pasture lands each year.
Guatemala and El Salvador (one recent but very illustrative example	Pacific Littoral of both Countries	From September 16-22, 1982, a tropical storm with an estimated year return period caused one of the greatest disasters in the recent history of both countries. Professional observers indicated that a substantial, although unquantified, proportion of the damages are attributable to watershed degradation and improper land use.	Flooding, landslides, destruction of roads, bridges, and other types of infrastucture. Losses Guatemala: - $30 million in agricultural produc- - 16 major bridges were totally destroyed and 8 others seriously damaged - Several million dollars of additional losses due to destruction of roads, landslides and the isolation of numerous population centers.

			- The Aguacapa hydroelectric project was seriously damaged. Only those costs limited only to the substitution of hydroenergy by fossil fuels during the estimated time of repairs (3 months) amount to $15 million. - An estimated minimum of 600 deaths; 10,000 refugees; 900+ homes destroyed and 1300+ partially destroyed. <u>El Salvador:</u> - $250 million estimated total material damages - 800+ deaths and an undetermined number of missing.
El Salvador	Rio Lempa	Improper land use leading to the accelerating siltation of hydroelectric reservoirs.	In the case of the 5th of November dam built in 1954, with an estimated useful life of 40 years, - 23 years after constructed its volume was so reduced by siltation that it had no regulatory capacity and was being operated as a run-of-the river plant.

II-F Summary of Watershed Management Survey ROCAP

In order to more clearly define the perceived needs of the national institutions in watershed management, ROCAP conducted a region-wide survey in February-March, 1983. The survey encompassed a wide range of institutions, including forestry, natural resources and planning agencies, as well as national electric companies, ministries of agriculture, and national universities. These institutions were divided into primary and secondary, depending on the degree of responsibility for watershed management. A total of fifty institutions were contacted in the six countries, of which 31 were classified as primary and 19 as secondary. The questionnaire survey covered four areas: training, technical assistance, information and awareness.

A. Highlights of the Survey

The responses to the questions on training are very useful in pinpointing priority needs. All fifty institutions indicated that current personnel require more training in watershed management. Given staff shortages, most institutions stated a preference for short-term training, but at the same time expressed support for both medium and long-term training where appropriate. The preferred training topic of the majority of institutions, for both short-term and long-term training, is watershed management and planning. Other topics of interest include watershed management project preparation and analysis, environmental impact analysis, and soil conservation.

The desire for improved planning was again reflected in technical assistance needs. Survey results show that the national institutions require assistance in more specific and/or sophisticated natural resources techniques relating to economics, information systems, soil conservation and forest hydrology.

All institutions indicated a need for more information including inventories of watersheds which would provide relevant determinants such as rainfall, runoff and other factors in the behavioral pattern of watersheds. Also needed is documentation on alternative plans and strategies which could be applied to watershed deterioration. All of the institutions also support a regional information system as a means of improving the collection and distribution of needed information and would be willing to provide information to a center for such a system.

Responses to the several questions on awareness of the importance of watershed management indicated that awareness decreases at higher levels, i.e., division chiefs have "high" awareness, directors of institutions medium awareness, and ministers "low". The latter is viewed as an obstacle to appropriate policy development and effective field implementation of watershed management efforts.

B. General Results of the Survey by Specific Questions*

1.0 Training.

1.1 "List the persons in your institution with long-term training in watershed management at the University or post-graduate level."

The total number of trained persons reported was 121 (70 in primary institutions and 51 in the secondary), but follow-up discussions indicated that the majority of the personnel had only received short-term training and that very few had actually received long term training at the University and post-graduate levels in watershed management.

1.2 "Are there enough personnel to carry out the responsibilities in watershed management you have been assigned?"

All of the primary and most of the secondary institutions stated their personnel were not sufficient to carry out the responsibilities assigned to watershed management.

1.3 "Does your institution proposed to increase its professional staff in watershed management for the period 1983-1984?"

Approximately half of the primary and secondary institutions reported they will increase their professional staffs in 1983-1984.

1.4 "Do the staffs of your institution need additional training in the science of watershed management to carry out its present and future work?"
The majority of institutions stated that additional training was needed.

*Informal translation of Report by R. Morales, CATIE.

1.5 "How many people need additional training at long, medium and short-term in 1984 and during the next 5 years?"

The number of people reported as needing additional training was 740 and appears to be low based on the responses to previous questions. In Panama RENARE alone plans to train 50 persons per year.

1.6 "Is long-term training a handicap due to the time element and shortage of personnel?"

The majority of institutions expressed that long-term training does present a problem, particularly due to the lack of sufficient personnel to fill-in for the people in training.

1.7 What basic education should persons have to be elegible for training (1984)?"

Almost unanimously, the primary institutions agree that a persons' basic professional education should be that of a civil engineer, forester or agricultural engineer (first 3 places in the survey). In the secondary institutions, these same disciplines were selected but Hydrologists, Geographers, and Biologists were also specified.

1.8 "Where is preferred location for long-term foreign training?

In all of the countries the majority of institutions surveyed (primary and secondary) selected CATIE as the preferred school for training their personnel in watershed management. This choice was influenced by the assumption that CATIE will offer training equal in quality to post-graduate training at universities outside the area.

1.9 "What position will persons occupy after receiving long-term training?"

In every country, the majority of institutions (primary and secondary) selected Resources Planning as the work to be done by trained personnel upon return to their countries.

1.10 "What help can your institution provide to personnel in training?"

In general, the institutions indicated that they could continue to provide salaries. Responses on providing other types of assistance, tuition, per diem, etc. Varied considerably, but in general, there was a willingness to provide adequate logistical support.

1.11 What areas of training are most important to the institutions for long and short-term training?

Primary institutions prefer long-term training in: 1) Planning in Watershed Management Planning, 2) Project Preparation and Analysis; and 3) Environmental Impact Analysis.

The secondary institutions prefer the long-term training in: 1) Watershed Management Planning; 2) Soil Conservation; and 3) Environmental Impact Analysis.

Primary institutions prefer short-term training in: 1) Watershed Mangement Planning and 2) Project Preparation and Analysis.

Secondary institutions prefer short-term training in: 1) Watershed Management Planning and 2) Environmental Impact Analysis.

1.12 "Which types of training are preferred if 100 weeks of training were available over five years?"

Primary and secondary institutions prefer to invest most of the 100 weeks of training in short courses and practical workshops.

1.13 and 1.14 "If institutions were to have the capacity for training which areas of assistance from CATIE would be useful?"

In every country primary and secondary institutions preferred CATIE's assistance through: 1) bibliographic documentation; 2) instructors; and 3) training modules.

2.0 Promotional Activities.

2.1 "What is the level of knowledge of officials in institutions on the importance of watershed management?"

Primary institutions indicated that the level of knowledge on importance of watershed management was "high" among the Technical Division Chiefs, "average" at the Director level and "low" at the Minister/Cabinet levels.

Most of the secondary institutions expressed that the level of knowledge was "high" at the university level; "average" for the directors of institutions, and "low" in Minister/Cabinet level.

2.2 "Is the level of knowledge (question 2.1) an obstacle for the institutions?"

In every country the primary and secondary institutions agree that lack of knowledge about watershed management by politicians and policy makers is an obstacle to the institutions for carrying out their assigned tasks.

2.3 and 2.4 "Which level needs more promotional effort and what methods would you suggest to improvethe level of consciousness?"

In general the institutions did not establish priorities among ministers, institution directors, chiefs of technical divisions, etc. In every country most of the institutions preferred (but not exclusively): observation trips, mobile seminars/symposiums, and round tables for the minister and director level and seminars, practical workshops, and short courses were suggested for the chiefs of technical divisions.

Other suggestions mentioned may be summarized as follows: publications about the lack of watershed management and make widespread distribution and more efficient use of newspapers, T.V. and the radio. Ministers in charge of watershed matters should make their colleagues in government more aware of the problem. Produce information bulletins and prepare documentary films. Make national studies on watershed situation. Improve the curriculum in universities. Establish a well managed watershed model in each country for demonstration purposes. Make case studies (successes and failures). Concentrate and focus all information towards watershed management planning.

2.5 "Which are the key groups that need more specific information?"

Primary and secondary institutions in every country agreed that principal groups needing this information are: 1) farmers living in key watrersheds; 2) individuals who make "high level" decisions; and 3) extension agents.

2.6 "Do the institutions provide information about watershed management to those involved in politics, to the public, and others?"

About half of the institutions offer information on watershed management.

2.7a "Is a greater information effort needed?"

The majority of institutions interviewed, in the 6 countries, agree that a greater effort is needed.

2.7b "What kind of cooperation is preferred from CATIE on information?"

Both primary and secondary institutions wanted information provided through technical assistance and training.

3.0 Development of a Document and Data center.

3.1a "What type of information does your institution need the most?"

Primary and secondary institutions indicated that the following types of information were needed: 1) aerial photography and cartographic information, 2) information on watershed characteristics and behaviour, including hydrologic information, 3) plans and strategies on watershed management - and bibliographic information.

3.1b "What are the types of information available on watersheds in each country?" Answers varied considerably. (See detail of survey.)

3.2a "Do technicians need additional training in the use of watershed information?"

Primary and secondary institutions agreed that technicians need additional training on how to use information on watersheds.

3.2b "What kind of training is needed by technicians for the use of watershed information?"

Institutions agree that priority be given to the development of management plans; development and implementation of operational plans and research techniques.

3.3a "Is technical assistance needed for storage, processing, analysis to use the data?"

Most of the primary and secondary institutions of all the countries agree that technical assistance is needed.

3.3b "Is training needed?"

Most of the institutions (primary and secondary) agree that it is and that "analysis and utilization of data" is the most appropriate topic for training.

3.4 "Would the institutions provide CATIE with the information on watersheds for the establishment of a regional data center?"

All primary and secondary institutions in each of the countries agreed to make this type of information available to CATIE.

3.5a "Would a data and information center on watersheds be useful at CATIE?"

Most of the primary and secondary institutions of all the countries agree on the utility of a regional data and information center.

3.5b "What are the priority services that a data and information center on watersheds at CATIE could provide?"

Primary institutions agree that the priority services are: a) technical information and material distribution; b) data bank/center; and c) bibliography and literature search. The secondary institutions chose the following priority services: a) data/bank center; b) technical material and information distribution; and c) data processing by computer.

4.0 Technical Assistance.

4.1 "Have the institutions contracted technical assistance?"

In the primary and secondary institutions some technical assistance has been provided mainly through bilateral assistance but with emphasis on natural resources management which gave some attention to the watersheds.

4.2 "Please list the technical assistance received by the institutions in the watershed management area."

Some of the institutions have received technical assistance in natural resources management, with little specific attention given to watershed management.

4.3 "What types of CATIE specialists would be used by the institutions if 100 weeks of services were available over the next five years?"

Primary and secondary institutions mentioned most often the Planning and Watershed Management Specialist and Natural Resources Economist. Other specialists mentioned were: Data Information Specialist, Forest Hydrologist, Soil Conservation Specialist and Instructional Materials Specialist.

4.4 "What types of specialists are required on a short-term basis by the institutions?"

The institutions (primary and secondary) mentioned, in addition to those specialists listed above, many different types of specialists in different areas, e.g. Investment Programming, Fire Control, Land Settlement Specialist; Legislation Specialist, etc.

4.5 "What is the preferred nationality of the country coordinator?"

Primary and secondary institutions have stated that nationality is <u>not</u> important.

4.6 "Preferences for the technical speciality of the country coordinator."

Primary institutions prefer that the coordinator be a watershed specialist or a generalist. Secondary institutions also prefer a watershed specialist, a generalist, or a hydrologist.

5.0 General

5.1 "Do the institutions already have projects or plans for watersheds in the future, where CATIE can participate?"

At the regional level, primary and secondary institutions identified up to 30 different on-going projects or planned projects in which CATIE can participate.

5.2 "What types of cooperation are desired for prioritary projects?"

Most of the institutions identified Technical Assistance for studies or plans related to specific projects among which are hydroelectricity, irrigation, wells, ranking watersheds according to priority, contamination of aquifiers, etc.